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**CLAIMS**

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[Claim(s)]

[Claim 1] The laser control unit characterized by to have a comparison means compare with the output voltage and the reference voltage of said current-electrical-potential-difference conversion means a photodetection means detect the output of semiconductor laser, and a current-electrical-potential-difference conversion means change the output current of said photodetection means into an electrical potential difference, an integral means perform charge and discharge according to the output of said comparison means, and a voltage-current conversion means transform into a current the electrical potential difference charged by said integral means, and supply semiconductor laser.

[Claim 2] Said integral means is a laser control unit according to claim 1 characterized by having a switching means, making said switching means into an ON state when performing quantity of light stabilization actuation of said semiconductor laser, and making said switching means into an OFF state when performing modulation actuation of said laser.

[Claim 3] A quantity of light setup of said semiconductor laser is claim 1 and the laser control unit of two publications which are characterized by carrying out by carrying out adjustable [ of said reference voltage ].

[Claim 4] Said voltage-current conversion means is a laser control unit according to claim 2 characterized by making said current driving means always drive in case semiconductor laser has the current driving means which passes the current below the threshold current which causes an optical oscillation to said semiconductor laser and modulates said semiconductor laser.

**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the laser control unit which stabilizes the optical output of semiconductor laser.

[0002]

[Description of the Prior Art] Although semiconductor laser has been applied in various fields in recent years, it has been important conditions to stabilize laser intensity in every field. In case the optical output of semiconductor laser is switched to a multistage story and used especially properly, stabilization of the optical output at the time of this switch is an important problem. Furthermore, since temperature dependence of semiconductor laser is large, an optical output changes sharply also by few temperature changes, and

stabilization of an optical output is much more difficult for it.

[0003] By the way, semiconductor laser has the property which is very much easy to damage to abnormal current and abnormal voltage. Conventionally, on the occasion of stabilization of laser intensity, abnormal current flowed to semiconductor laser, or abnormal voltage might be impressed, and the rate of breakage of semiconductor laser was large. Moreover, the transistor for a modulation is conventionally used for the modulation of semiconductor laser. Usually, modulation frequency of this transistor for a modulation is performed by about 4-10MHz, and quick responsibility is required.

Therefore, the transistor for a modulation is for RFs and is adopted. However, power loss arose in relation with a junction capacitance, and the transistor for high frequency had the problem that the transistor of a high current had to be arranged so that it may compensate this power loss.

[0004]

[Problem(s) to be Solved by the Invention] While accomplishing this invention in view of the above-mentioned situation and aiming at improvement in precision in stabilization of the optical output of semiconductor laser, the failure rate of semiconductor laser can be reduced sharply, without abnormal current etc. flowing on the occasion of stabilization, and power loss is reduced, responsibility is good and control of a minute optical output is also aimed at offering a possible laser control unit.

[0005]

[Means for Solving the Problem] A laser control means according to claim 1 has a comparison means compare with the output voltage and the reference voltage of said current-electrical-potential-difference conversion means a photodetection means detect the output of semiconductor laser, and a current-electrical-potential-difference conversion means change the output current of said photodetection means into an electrical potential difference, an integral means perform charge and discharge according to the output of said comparison means, and a voltage-current conversion means transform into a current the electrical potential difference charged by said integral means, and supply semiconductor laser.

[0006] Said integral means has a switching means, when performing quantity of light stabilization actuation of said semiconductor laser, it makes said switching means ON condition, and a laser control device according to claim 2 makes said switching means an OFF condition, when performing modulation actuation of said laser.

[0007] A laser control unit according to claim 3 performs a quantity of light setup of said semiconductor laser by carrying out adjustable [ of said reference voltage ].

[0008] A laser control unit according to claim 4 makes said current driving means always drive, in case said voltage-current conversion means has the current driving means which passes the current below the threshold current from which semiconductor laser starts an optical oscillation to said semiconductor laser and modulates said semiconductor laser.

[0009]

[Function] According to that comparison result after a photodetection means' detecting the optical output of semiconductor laser according to the laser control unit according to claim 1, changing the output current of this photodetection means into an electrical potential difference with a current-electrical-potential-difference conversion means and comparing with the reference voltage of a comparison means, an integral means performs charge and discharge, the charge electrical potential difference of an integral means is

further transformed into a current with a voltage-current conversion means, and it is made to supply semiconductor laser.

[0010] Therefore, it will be controlled so that the optical output of semiconductor laser becomes fixed, and stabilization of an optical output with a very high precision can be attained irrespective of temperature fluctuation. Since especially the comparison means has the cis- TERISHISU property, its stabilization of a comparative judgment improves and it can be contributed to the improvement in precision of stabilization of an optical output.

[0011] Moreover, since a current is gradually raised by quite late time amount by work of an integral means when semiconductor laser is turned on, abnormal current does not flow to semiconductor laser and the failure rate of semiconductor laser is reduced sharply.

[0012] Furthermore, since the optical output of optical output setting reference voltage and semiconductor laser is in proportionality, an exact optical output setup can be performed.

[0013] Since according to the laser control device according to claim 2 the switching means formed in the integral means is set to ON in the case of quantity of light stabilization actuation of semiconductor laser and is made into an OFF state in the case of modulation actuation, stabilization of the optical output of semiconductor laser can be ensured.

[0014] Since a quantity of light setup of semiconductor laser is performed by carrying out adjustable [ of the reference voltage ] according to the laser control unit according to claim 3, a minute optical output is controllable by changing reference voltage.

[0015] According to the laser control unit according to claim 4, in case semiconductor laser is modulated, since the current below the threshold current which causes an optical oscillation is supplied to semiconductor laser by actuation of a current driving means, responsibility can control semiconductor laser by the good condition, without being accompanied by power loss using the current driving means of small power.

[0016]

[Example] It explains referring to one example of the illustration which applied this invention hereafter.

[0017] Drawing 1 is the block diagram of the system for recording information on a record medium by the laser beam. The information on the host side systems 1 (a computer, body of a word processor, etc.) which deliver information is given to the data control section 2. In the data control section 2, the information given from the host side system 1 is changed into the data of dot correspondence, and it memorizes in page memory.

[0018] The data of this memorized dot image are sent out to the printing control section 100.

[0019] In the printing control section 100, by modulating a laser beam for the inputted dot image data, it writes in on a record medium, the development imprint of it is carried out, and said dot image data is printed on a record form.

[0020] Drawing 2 shows the device detail drawing with a video interface of a printer 300, and a printer 300 contains the printing control section 100 of drawing 2 .

[0021] In drawing 2 , the photo conductor as image support for 300 to record the body of a printer by the laser beam, and for 301 record information and 302 consist of two or more red LED with the electric discharge lamp for discharging the charge of said photo

conductor 301 to an initial state. 303 is an electric discharge lamp for gathering imprint effectiveness, and consists of two or more red LED like said electric discharge lamp 302. An imprint charger for an electrification charger for 304 to electrify said photo conductor 301 in predetermined potential uniformly and 305 to make a form imprinting the toner developed on said photo conductor 301 and 306 are the exfoliation chargers for making the form after an imprint separate from said photo conductor.

[0022] A development counter for 307 to make the electrostatic latent image written in by the laser beam on said photo conductor 301 developing and 308 are the components of said development counter 307, are a magnet roller for making said toner adhere to the electrostatic latent image on said photo conductor 301, and rotate in the direction of an arrow head.

[0023] The auto toner probe for 309 contacting the developer of said magnet roller and measuring the toner ratio concentration of a developer and 310 are the cleaning blades for removing the toner which remains on said photo conductor 301 after an imprint.

[0024] A scanning motor for the polygon mirror of eight face pieces for a laser-scanner unit for 311 to scan a laser beam, become irregular and record the video data inputted from the data control section on said photo conductor 301, and 312 to draw the laser beam from a laser diode on said photo conductor 301 and 313 to rotate said polygon mirror 312 at high speed and 314 are the f-theta lenses for making regularity the scan speed of the laser beam on said photo conductor 301. 315 and 316 are the reflective mirrors for leading the laser beam from said scanner unit 311 to said photo conductor 301.

[0025] An upper case feeding roller for the upper case side cassette by which 317 can contain 500 sheets of forms, and 318 to pick out one sheet of form at a time from said upper case cassette 317, the upper-case-paper-less switch which detects that the form of 319 was exhausted to said upper case cassette 317, and 320 are upper case cassette size pilot switches which have been prepared in said upper case cassette 317 and which consisted of 4 bits which detects the mark for size discernment. In 321, a lower-berth feeding roller and 323 show a lower-berth-paper-less switch, and 324 shows a lower-berth cassette size pilot switch, respectively. Moreover, it has usable structure also in the cassette which can contain a lower-berth side 250 sheets in an upper case side.

[0026] The feed roller for manual bypass for the manual feed switch which detects the form with which 326 was inserted from the manual bypass guide 325, and 327 to convey the form, after insertion is checked by said manual feed switch 326, and 328 are manual stop switches which detect the form conveyed with said manual paper feed roller 327.

[0027] A resist roller for 329 to make it take the synchronization with the image and form which were developed on said photo conductor 301, and 330 with said exfoliation charger 306 The separated form to a fixing assembly A thermistor for a heater lamp for a fixing assembly for the conveyance belt for conveying and 331 to fix the toner on the imprinted form and 332 to heat the roller for fixing, and for 333 heat said fixing roller and 334 to detect the skin temperature of said fixing roller and 335 A delivery roller, 336 is a delivery switch for detecting the form discharged from said fixing assembly 331.

[0028] A cooling fan for 337 to cool the inside of a printer 300, the high-pressure transformer which 338 makes generate the high-pressure electrical potential difference impressed to said electrification charger 304, the imprint charger 305, the exfoliation charger 306 and said development counter, and a magnet roller 308, respectively, the



power unit which generates DC electrical potential difference on which 339 is used for each control, and 340 are PC board units which control a printer 300.

[0029] 342 is a drum temperature sensor for detecting the temperature of a photo conductor 301 established near the photo conductor 301, and the very small thermistor of thermal resistance is used.

[0030] Drawing 3 is the perspective view showing the outline of the part for performing information record to said photo conductor 301 by the laser beam. In drawing 3, the laser beam which came out from semiconductor laser 344 is amended by the collimator lens 343 at parallel light, and is applied to the 1st page in which eight face pieces of the polygon mirror 313 have the parallel light. The laser beam which carried out incidence of it to said polygon mirror since the polygon mirror 313 was carrying out high-speed rotation in the direction of an arrow head by the scanning motor 312 lets the f-theta lens 314 pass, and the range of the beam scanning zone 348 is scanned rightward from the left. Some laser beams in the beam scanning zone 348 are led to the beam detector 346 by the reflective mirror 345. Therefore, said beam detector 346 detects the laser beam scanned for every one horizontal scanning by the 1st page of said polygon mirror 313. Moreover, the laser beam by which incidence is not carried out to the reflective mirror 345 in the beam scanning zone 348 is irradiated by said photo conductor 301. The place where the laser beam on the photo conductor 301 in drawing 3 is scanned is shown in 349. 304 shows an electrification charger and 347 shows a form, respectively. In addition, as shown in drawing 2, when the laser beam which passed the f-theta lens 314 is not irradiated by the direct photo conductor 301 but an actual printer is reflected by the reflective mirrors 315 and 316, \*\*\*\*\* does not illustrate the reflective mirrors 315 and 316 for convenience in drawing 3 to a photo conductor 301. The laser beam which passed the f-theta lens 314 is shown so that the direct photo conductor 301 may irradiate.

[0031] Here, the configuration of said reflective mirror 345 is explained with reference to drawing 42. As shown in this drawing, it is attached on the screw 455 through the flat spring 454 on the supporter material 456 located outside a beam incidence field, the fine-tuning screw 457 is formed in the lower part of this flat spring 454, and this reflective mirror 345 can change now the include angle of the reflective mirror 345.

[0032] The laser-scanner unit shown in drawing 3 and drawing 42 is intercepted from the outside so that clearly also from the place shown in drawing 2, and he is trying for a scanning beam not to leak. And the detection result of the beam detection by the beam detector 346 is displayed in the proper location of the scan panel shown in drawing 6.

[0033] Drawing 4 is the explanatory view of the pass-before resist roller sensor 394. The purpose of the pass-before resist roller sensor 394 detects the form at the time of cassette feeding to the manual stop switch 328 in drawing 2 performing only detection of a manual bypass form. In drawing 4, paper is fed to the form to which paper was fed from the upper case cassette 317 and the lower-berth cassette 321 by one of the upper case feeding roller 318 and the lower-berth feeding rollers 322 even to the resist roller 329 along with a form guide plate. At this time, the light which came out from the light emitting diode 393 when feeding was performed correctly can check the form to which paper was fed when it was intercepted with a form and light did not go into said pass-before resist roller sensor 394. Moreover, since a form does not reach to the location of said pass-before resist roller sensor and incidence of the light from said light emitting diode 393 is continuing being carried out to said pass-before resist roller sensor when

feeding is not able to carry out correctly, it can recognize that paper was not fed to the form.

[0034] Drawing 5 is the schematic diagram of the reversal tray 381 which is an option unit. Usually, the tray 397 of a noninverting form is attached in the appearance shown in the printer 300 at drawing 2 . When such a noninverting form is used, since it turns down, since data must be sent out from the last page, the first print form has the fault to which the file approach of the information on a host system 1 becomes complicated from information delivery equipment (host system 1). Therefore, in order to compensate said fault, this reversal tray 381 is indispensable.

[0035] The form which passed the delivery roller 335 of a printer 300 in drawing 5 is contained with the reversed mold with the time of passing said delivery roller 335 on a tray 384 with the conveyance roller 382,383. Therefore, although the first page is the bottom since the printing side of a form has turned down, from a tray 384, if drawing and the printing side of a form are made into a side front, the first page can turn up, the last page will turn them down, and the fault of the above-mentioned noninverting form tray 397 can solve a form. In addition, 385 is a form stopper and can be made to slide in this drawing according to the conveyance lay length of a print form. Light emitting diode for a delivery switch for a form presser-foot actuator for 388 to prevent the relief of the form contained by the tray and 395 to check that the form has been normally contained by the tray 384 and 391 to check the existence of the form in a tray 384 and 392 are the tray sensors by the side of light-receiving. When a form 390 is in a tray 384, light does not shine upon the tray sensor 392, but when there is no form 390, and light shines upon the tray sensor 392, the existence of a form 390 can be detected.

[0036] The other examples of form existence and a formful of a detecting element are shown in drawing 44 . while this forms an actuator 388 focusing on the rotation supporting point 386 -- the upper part -- a lever 398 -- forming successively -- the tip of a lever 398 -- isolation -- a means -- a solenoid 389 and discharge -- a means -- it energizes in the any 1 direction with the coil 387, and he moves a lever 398 according to the condition that paper is contained by the paper stowage 390, and is trying to detect the condition at this time with the detection means 401,402, for example, two or more sensors In the various conditions of an actuator 388, "those with paper" and the location of a3 will be [ the location of a1 / "paper is full" and the location of a2 ] in the condition of "having no paper." printing when said isolation means 389 should isolate an actuator 388 while discharge migration of the form 390 is carried out into a paper output tray 384 at least, and a form should be detected -- working or during a halt, a solenoid 389 becomes off synchronizing with the condition signal at that time, the elongation of an actuator 388 is canceled, and detection actuation is performed. For this reason, trouble does not arise in discharge actuation, without the discharge tip of a form 390 colliding with an actuator 388.

[0037] In addition, the form sent in a paper output tray is detected by the delivery switch 395 for every sheet, it counts with the delivery memory counter (RAM107 of drawing 3 ) which these contents mention later, and number of sheets is detected. And if it becomes "full [ paper ]", while being displayed on the tray full lamp 358 of drawing 6 , said memory counter is cleared.

[0038] Drawing 6 is the detail drawing of the control panel of a printer 300.

[0039] In drawing 6 , in 350, top covering of a printer 300 and 351 become a front cover,

352 has become maintenance covering, and when a paper jam, toner supply, etc. arise, said front cover 351 is opened in the direction of an arrow head, and processes. Moreover, although said maintenance covering 352 has structure opened in the upper part, it has structure which cannot be opened unless it is in the condition which opened said front cover 351 in the direction of an arrow head, and prevents an operator's operation mistake.

[0040] 353 is the mechanical counter of 6 figures and is carried out plus 1 for every printing to one sheet of form. The select switch with which 354 selects online/off-line, and 355 correspond to said select switch 354. The Select light turned on at the time of online, and 356 by the seven segment LED of a single figure The contents of an error at the time of a serviceman call, The mode number at the time of maintenance mode etc. The numerical indicator to display, the line indicator which indicates that, as for 357, the power source is supplied to the printer 300, the tray full lamp which tells that 358 is full of a print form to said reversal form tray unit 381, and 359 the detail of the operating state of a printer The color LCD drop to display is shown, respectively. The total counter 353 thru/or the LCD drop 359 explained until now is always operated or displayed. Next, the part which cannot be operated unless it opens said maintenance covering 352 is explained. Only a serviceman operates the following parts.

[0041] The maintenance switch for selection of maintenance mode and exchange mode in 403, the display lamp in which it is shown that 406 is in a maintenance mode condition, the display lamp in which it is shown that 407 is in an exchange mode condition, and 404 selection of the mode of operation NO at the time of each mode The selecting switch to perform, the thing \*\*\*\* selection lamp which 408 can selection operate by said selecting switch 404, and 405 Selection and the above-mentioned maintenance in test print mode, The test switch for performing exchange and actuation in each mode condition of a test print, the volume for the Maine exposure adjustment which 360 mentions later, and 361 show the volume for shadow exposure adjustment, respectively. Moreover, by hand, said not both volumes of 360,361 can be turned, where it has the structure where the driver for adjustment is inserted and turned and said maintenance covering 352 is opened.

[0042] Drawing 7 is the detail drawing of said LCD drop 359, and explains the function of each display segment below.

[0043] 371,372 is a segment which shows standby of a printer 300, a ready state, etc., and 371,372 switches off only 371 by the 371,372 concurrent LGT and the ready state at the time of lighting and print actuation at the time of the standby to a fixing assembly ready.

[0044] 373 blinks at the time of jam generating of the feed section, and the segment which shows the feed condition also blinks it to coincidence. Namely, the lower-berth cassette 363 blinks at the time of the upper case cassette 364 and a lower-berth cassette at the time of the manual bypass assignment 365 and upper case cassette mode at the time of manual bypass mode. In the case of a conveyance system (resist roller 329 or subsequent ones) jam, 374 blinks. A feed segment as well as [ at this time ] a feed jam blinks to coincidence. The toner collected by the cleaning blade 310 of drawing 2 blinks 375, when the toner back (not shown) is full. 376 blinks, when a toner is lost in the toner hopper (not shown) of a development counter 307. 377,378 blinks, when the serviceman error mentioned later occurs. 379 blinks, when the operator call mentioned later occurs. 380 blinks, when there is no form in the cassette chosen. 362 displays the size of the paper chosen. For example, the upper case cassette side is chosen, if it is the form

cassette of A4 length, A4-R will light up, and if A6 is chosen in manual bypass mode, A6 will light up. When, as for 363, the lower-berth side cassette is chosen and, as for lighting and 364, the upper case side cassette is chosen, lighting and 365 are turned on when manual bypass is chosen. 366 expresses the configuration of a printer 300, lighting and 367 always express a photo conductor 301, lighting and 368 always express the up configuration of a printer 300, and lighting and 369 always turn on said 368 by turns at the time of a conveyance section jam (at the time [ Said 374 ] of flashing) except the time of a conveyance section jam. 370 is five segments which display the conveyance condition of a form, and while one segment lights up from right-hand side to left-hand side, it moves.

[0045] Drawing 8 is the outline block diagram of the data control section 2 in said drawing 1. The character code information and image information which have been sent out from the host side system 1 are made to memorize after data conversion in the data control section 2 on the page memory 20 corresponding to a dot corresponding to the printing area on the form of a printer 300. Moreover, the data on the memorized page memory 20 are sent out to a printer 300, and printing actuation is made to perform.

[0046] It consists of the data control sections 2 so that two kinds of information may be received. That is, it is character code information (JIS eight-level code etc.), and in this case, with a character generator 15, one generates the character pattern corresponding to that character code, and it memorizes the dot information on a character pattern on the page memory 20. Another side is image information, and in this case, since it is already inputted in the form of dot information, it memorizes on the page memory 20 as it is. Henceforth, the outline of the data control section 2 is explained with reference to drawing 8.

[0047] The information on the host side system 1 is sent to an interface 50 through a signal line SO 1, and said information is further memorized by the data latch 3.

[0048] The signal line SO 2 of an interface 50 and a host system 1 is sent out from the host side system 1. The signal line SO 3 for control of the strobe signal of data and others is the busy signal and status signal line from a data control unit.

[0049] A format of the information sent from the host side system 1 is shown in drawing 9 and drawing 10. The alphabetic character identification code which shows that the example of a format of drawing 9 is the format in the case of character code information, and is character code information, and the paper size code which shows the size of the form to print are contained in the beginning for 1 page. Character code data are contained henceforth in order of the 1st line and -- of 2nd line the n-th line, and the END code which finally shows the end of data of the page is contained. Moreover, the character code data for one line consist of the code which shows a character size, the character code, and the LF code showing the delimiter of data of one line.

[0050] Drawing 10 is the format in the case of image information, and the image identification code which shows image information, and the paper size identification code which shows the size of the form to print are contained in the beginning of the data for 1 page. Henceforth, image data is contained in order of one line and two lines -- m lines. Moreover, since it is specified with said paper size discernment data, data of one line are automatically distinguished by counting by the data specified in the data control section 2 side.

[0051] The input from a distributor 4 is processed as follows. The information which

always went into the distributor 4 with the output line SO 4 is inputted into the decoder 5 from the distributor 4. First, if the case of character code information is described, and the alphabetic character identification code of drawing 9 is inputted into a decoder 5, the output of a decoder 5 will be inputted into the main control section 6 through a signal line SO 5. In the main control section 6, it distinguishes that the information inputted is character code information, and the following paper size data are inputted into the page code buffer control circuit 7 to a distributor 4 with a signal line SO 6, and an appearance command is carried out. Therefore, paper size data are inputted into a page code buffer control circuit through data-line SO7 from a distributor 4. Next, the continuing data to the 1st line and -- of 2nd line the n-th line are inputted into a page code buffer through data-line SO8 from a distributor 4. Character code data are memorized by the memory area on the page code buffer 9 specified by the address counter 8 at this time. If the input of the character code information for 1 page is completed to a page code buffer and the END code of drawing 9 is detected by the decoder 5, the END code detection will be told to the main control section 6 and the page code buffer control circuit 7 with signal lines SO5 and SO9, respectively. The page buffer control circuit's 7 check of that the character code input for 1 page to a page code buffer was completed with the signal line SO 9 performs the data storage in the dot unit to the page memory 20.

[0052] Correspondence with the room on the page memory 20 and a form is shown in drawing 11. In drawing 11, a broken line shows the outside of each form. 25 [ namely, ] -- the tip (each size community) of a form, and 24 -- the left end (each size community) of a form, and 28 -- in the right end of A3 size form, and 31, the back end of A5 size form and 30 show the back end of A4 size form, and, as for the right end of A5 size form, and 27, 29 shows [ the right end of A4 size form, and 26 ] the back end of A3 size form, respectively. 32 shows the point of the address ADR of the address counter 19 for read-out, and the address counter 18 for writing (0 0). Both ADR (0 0) expresses that the perpendicular direction address (ADRV) and the horizontal address (ADRH) are "0" here. That is, the address counter 18 for writing and the address counter 19 for read-out are realized from the perpendicular direction address (ADRV) and the horizontal address (ADRH), as shown in drawing 12, ADRV expresses the perpendicular direction address ( drawing 11 arrow head b), and ADRH expresses the horizontal address ( drawing 11 arrow head c).

[0053] As for the level address (A3 HE) of the last of A3 size form, and 44, 43 is [ the level address (A4 HE) of A4 size form and 45 ] the level addresses (A5 HE) of A5 size form. Similarly, in 46, the perpendicular address (A3VE) of the last of A3 size form and 47 express the perpendicular address (A4VE) of A4 size, and 48 expresses the perpendicular address (A5VE) of A5 size. As for 33, perpendicular address ADRV=0 of A3 size, the point ADR of level address ADRH=A3 HE (O, A3 HE), and 34 show ADR (O, A5 HE) similarly, respectively, as for ADR (O, A4 HE) and 35. Moreover, as for 36, the point ADR (A3 VE and O) of perpendicular address ADRV= (A3VE) of A3 size and level address ADRH=O and 37 show ADR (A5VE, 0) similarly, respectively, as for ADR (A4 VE and O) and 38. 39 -- the point ADR of perpendicular address ADRV=A3VE of A3 size, and level address ADRH=A3 HE (A3VE, A3 HE) -- similarly, 40 shows ADR (A4VE, A4 HE) and 41 shows ADR (A5VE, A5 HE), respectively. Storage in the dot image of the character pattern to the page memory 20 with the above rooms is performed as follows. Character-size data of the 1st line are read through a signal line S10 in the

page code buffer control circuit 7 from the page code buffer 9. 40x40 and two sorts of fonts of 32x32 dots have been to the base, and the class of character size in this example distinguishes a character size in read character-size code, and sends [ in the page code buffer control circuit 7 ] the distinction signal to the page memory control circuit 17 through a signal line S13 to a character generator 15 through a signal line S11, respectively. In the page memory control circuit 17, control of a paragraph pitch and a character pitch is performed, and character-size area is switched with a character generator 15 with said character-size distinction signal, respectively.

[0054] The character code after character-size data is transmitted to the area specified as the line buffer 10 with the memory space for one line with the line address counter 11. After the transfer to the line buffer 10 of the character code data for one line is completed, the line address counter 11 returns to the initial address (0). First, the writing to the page memory 20 of Rhine ( drawing 11 , Rhine, 57) of the 1st character-font perpendicular direction is performed. Here, Rhine / scanning counter 13 is set to initial value (0 0), and the value of the address counter 18 for a store serves as ADR (0 0). The character code data of the line buffer 10 are latched to the output latch 12 in order in order to perform read-out in the cycle of sequential regularity and to take the synchronization with a line counter 13 from a top digit. If a top character code (this example "T" alphabetic character) is latched to the output latch 12, the output of the character code, and the Rhine / scanning counter 13 will be compounded in the synthetic circuit 14, and it will be inputted into a character generator 15 as a character-pattern select code of a character generator 15. Here, if the configuration of Rhine / scanning counter 13 is explained, 6 bits of high orders have become the counter, i.e., the counter of the lengthwise direction of a character pattern, which counts a scan line, zero to 39 \*\*\*\*\* , in the case of the alphabetic character of 40x40 dots, it will count by the paragraph pitch control line, and it will return to "0." The low order triplet serves as a counter of the longitudinal direction of a character pattern, in the case of the font of 40x40 dots, it counts by 0-4 plus character-pitch control, and it returns to "0" (the output of a character generator 15 is because 8 bits is parallel).

[0055] Hereafter, the actuation in for spacing of 8 bits of the lengthwise direction of a part for spacing of 8 bits of the longitudinal direction of a font size 40x40 and an alphabetic character and an alphabetic character is explained. If a top character code ("T") is set to the output latch 12 as mentioned above, the output of the character code, and the Rhine / scanning counter 13 will be compounded in the synthetic circuit 14, and it will be inputted into a character generator 15 as a character-pattern select code of a character generator 15. At this time, since the value of Rhine / scanning counter is (0, 0), the data (8 bits) of eye lengthwise direction "0" Rhine eye and longitudinal direction "0" watch of that character pattern are outputted to the output of a character generator 15. The output data of a character generator 15 are written in the address on the page memory 20 which was once latched to the output latch 16 and was specified as him by the page memory control circuit 17 with the address counter 18 for a store, in order [ to the page memory 20 ] to take the synchronization of writing. In this case, since the value of the address counter 18 for a store serves as ADR (0 0), it is written in the address of the perpendicular address "0" and level address "0." And after the store of 1 byte of character pattern is completed, the value of Rhine / scanning counter changes to (0, 1), and the value of the address counter 18 for a store also changes to ADR (0 1). Therefore, after the

data of eye lengthwise direction "0" Rhine eye and longitudinal direction "1" watch of a character pattern are outputted to the output of a character generator 15 and being latched to the output latch 16 like the above-mentioned, it is written in the ADR (0 1) address of the page memory 20. Thus, after the writing of the data of the last (data of the "4th" watch) of the lengthwise direction "0" Rhine eye of one character pattern is completed, in the value of Rhine / scanning counter, (0, 5), and the address counter 18 for a store serve as ADR (0 5). Since spacing of the longitudinal direction of an alphabetic character is 8 dots (1 byte), the output of a character generator 15 is compulsorily set to "0" altogether by the command from the page code buffer control circuit 7, "0" is written in the ADR (0 5) address of the page memory 20, after write-in actuation termination, a line address counter is added "1" and the following character code is set to the output latch 12 from the line buffer 10. Moreover, (0, 0), and the address counter 18 for a store are set to ADR (0 6) by Rhine / scanning counter. Therefore, as for a degree, write-in actuation to the page memory 20 of the data of the character-pattern lengthwise direction "0" Rhine eye of "0" is performed. At this time, the address counter 18 for a store carries out sequential count-up with ADR (0 6), (0, 7), (0, 8), (0, 9), and (0, A), and writes the character-pattern data of O in the address specified with the address counter 18 for a store, respectively. And if the value of (0, B) Rhine / scanning counter 13 is set to (0, 5) by the value of the address counter 18 for a store, "0" is written in the page memory 20 like the above-mentioned, after write-in actuation termination, a line address counter will be added "1" and the following character code will be set to the output latch 12 from the line buffer 10. [0056] Moreover, (0, 0), and the address counter 18 for a store are set to ADR (0 C) by Rhine / scanning counter 13. Thus, the writing to the page memory 20 of the character-pattern data of a lengthwise direction "0" Rhine eye is performed one by one, and if the "LF" code is outputted to the output of the line buffer 10, the "LF" code detecting signal will be told to the page code buffer control circuit 7 through an output line S14, and write-in actuation of the character pattern from a character generator 15 will stop. And after it, sequential plus "1" is carried out and the address counter 18 for a store writes "0" in the page memory 20 compulsorily. And if present A3 size is specified and the value of the address counter 18 for a store will become 33 points of the value, i.e., drawing 11, of ADR (0 A3 HE), 18(0) Rhine / ADR (1 0), line address counter 11, and scan counter 13 will be set to (1, 0) for the address counter 18 for a store after said compulsive "0" write-in actuation, respectively. And "T" which is a top character code is again set to the output latch 12 from the line buffer 10. And the character-pattern data of the lengthwise direction "1" Rhine eye of a character pattern are written in \*-JIMEMORI 20. The lengthwise direction "2", "3" which are a character pattern similarly -- Termination of the write-in actuation to "39" Rhine eye sets [ the address counter 18 for a store ] (0) Rhine / scanning counter 13 to (28, 0) for ADR (28 0) and the line address counter 11, respectively. Although write-in actuation of the character-pattern data for one line is termination above, since a paragraph pitch is next every 48 lines, it remains, and "0" is compulsorily written in the page memory 20 by eight lines. And after the writing of "0" for eight lines is completed, the line address counter 11 is set to the point (30 0), i.e., ADR, of 61 of drawing 11, and (0) Rhine / scanning counter is set to initial value (0 0) for the address value of the address counter 18 for a store, respectively. All write-in actuation that also contained the paragraph pitch for one line now is completed. And the character code data of the 2nd line as follows are transmitted to the line buffer 10 from

the page code buffer 9. After a character code data transfer is completed, the line address counter 11 returns to the initial address (0). Then, the writing of character-pattern data of the 2nd line is performed in the same actuation as the writing of character-pattern data of the 1st line. Therefore, completion of all of write-in actuation of the 2nd line of character-pattern data sets [ the address value of the address counter for a store ] (0) Rhine / scanning counter to (0, 0) for ADR (60 0) and the line address counter 11, respectively. Thus, one by one, the character code of each line is patternized, and pattern data are written in on the page memory 20, and it dies. And if the "END" code which shows a last line is detected from a line buffer, data write-in actuation of said character pattern will stop. And while setting the output of a character generator 15 to "0" compulsorily through a signal line S13 from the page code buffer control circuit 7, write-in termination of character-pattern data is told to the page memory control circuit 17. In the page memory control circuit 17, if said write-in terminate signal is received, "0" will be compulsorily written in to the remaining memory areas in the page memory 20 by which paper size assignment was carried out henceforth to the last memory address (in the case of A3 size Fig. 1139 -point ADR (A3VE, A3 HE)). And writing and all the write-in actuation to the page memory 20 of the character-pattern data for one-page assignment paper size complete "0" to 39 points of drawing 11. And (0) Rhine / scanning counter 13 is altogether initialized [ the address counter 18 for a store ] for ADR (0 0) and the line address counter 11 by (0, 0).

[0057] Next, the case where the data sent from the host side system 1 are image information is described. If the image identification code of drawing 10 is inputted into a decoder 5, the output of a decoder 5 will be inputted into the main control section 6 through a signal line S05. In the main control section 6, it distinguishes that the information inputted is image information, and the following paper size data are inputted into the page memory control circuit 17 to a distributor 4 with a signal line S06, and an appearance command is carried out. Therefore, paper size data are inputted into the page memory control circuit 17 through the data line S07 from a distributor 4. Next, the continuing image data 1 and 2 and the image data to --m are inputted into the page memory 20 through the data line S15 from a distributor 4. The image entry-of-data approach to the page memory 20 is performed as follows. A page memory control circuit sets the address counter 18 for a store to ADR (0 0) so that it may write in the image data following a degree from 32 points (address ADR (0 0)) of drawing 11 , if said paper size identification code is received. And the data length for the horizontal direction of one line is decided by referring to the table in the page memory control circuit 17 from paper size identification code. Therefore, supposing the paper size of the image information to be inputted into the page memory 20 from now on is A4, the data length of one line will become the value HE to 44 points (A4 HE) of drawing 11 , i.e., "A4." Since the die length of the image information per [ which is sent from the host side system 1 ] line naturally also serves as "A4 HE", a data length is "A4VE" and, as for several m image data, the image data 1 of Fig. 10, image data 2, and -- image data m have become the value of 47 points of drawing 11 , i.e., "A4VE." Therefore, for 32-point ADR (0 0) - 34-point ADR (0 A4 HE) of drawing 11 , and image data 2, to the page memory 20, Rhine and the image data 3 of 51 points are [ the image data 1 of drawing 10 ] Rhine of 52 points. -- In Rhine, therefore the last address of 37 points, image data m serves as ADR (A4VE, A4 HE) 40 point. Thus, image information is written in the page memory 20,



controlling the address counter 18 for a store.

[0058] Thus, the character-pattern data 13 written in the page memory 20 send out the data which print the data of the address shown in the address counter 19 for read-out to a printing control section through an interface bus S17 through the sequential output latch 21, a gate circuit 23, and an interface 22. The command data line with which S17 performs the status data line from a printing control section to a printing control section, and S18 performs assignment of a mode of operation etc. in drawing 8 , and S19 and S20 command data and the strobe signal line at the time of printing data forwarding, and S21 The page and signal line with which the Horizontal Synchronizing signal line from a printing control section and S23 are the same, and the busy signal line from a printing control section and S22 tell termination of printing data, and S24 The ready signal line of a printing control section, the print request signal line which tells the condition which S25 can print, the selection signal line with which S26 specifies the contents of data of the data line in said interface bus S17 (two lines), S27 is a printing start signal line which orders it initiation of printing actuation to a printing control section.

[0059] If it explains in more detail about the time of the data forwarding to a printing control section, in printing [ section / 2 / data control ], a printing control section will send Horizontal Synchronizing signal S22 to the start signal line S27. With this Horizontal Synchronizing signal S22, first Rhine of 32 points of drawing 11 , The address counter 19 for read-out also changes the address of one line at a time one by one according to said Horizontal Synchronizing signal S22., therefore it carries out sequential sending out of each data of Rhine of 51 points with following Horizontal Synchronizing signal S22 If the data of the area where this actuation was repeated and the page memory 20 was specified are sent out to a printing control section and a page and a signal S23 are received, sending out of data will be compulsorily stopped, until it receives the page and signal S23 from a printing control section. The timing which takes out a page and a signal S23 with a printing control section is taken out with the same timing as said Horizontal Synchronizing signal S22. Moreover, at correspondence with the memory address of drawing 11 , by last Rhine A3 of the memory area of the paper size, 46 point, in A4, it is the same as 47 points, or is outputted from a printing control section to the timing before it.

[0060] Moreover, the value of the address counter 19 for read-out and the address counter 18 for a store is always compared, and if sending out of the printing data from the page memory 20 is started, if the value of the address counter 19 for read-out is larger, it will be controlled by the page memory control circuit 17 to permit write-in actuation to the memory area which sending out of the data ended. Therefore, the loss of the write time to the page memory 20 decreases very much.

[0061] Drawing 13 shows the block diagram of the printing control section 100 in drawing 1 . In drawing 13 , a microprocessor for 101 to control each unit in the printing control section 100 and 102 are the interrupt control circuits for controlling the interrupt to a microprocessor 101, and tell the interruption-request signal from each of the page from the command signal line S30 from an interface circuitry 122, and the printing data write control circuit 19 and a signal line S29, and the time-out signal line S28 from the general-purpose timer 103 to a microprocessor 101. 103 is a general-purpose timer and generates basic timing signals for control, such as paper conveyance and a circumference process of a drum. This general-purpose timer 103 is set as 10msec(s) by this example.

104 is ROM (read-only memory) and all the programs for control for operating the printing control section 100 are contained. The data table which 105 is similarly ROM and is different in said ROM104 is contained. The contents of the data table are shown in drawing 45 . In drawing 45 , the data for right margin control are contained in the address (4000 4001) at the data for the Top Margin control in the case of paper size A3, and the address (4002 4003) in the data for left margin control, and the address (4006 4007) in the data for bottom margin control, and the address (4004 4005), respectively. The top in the case of paper size B4, a bottom, the left, and each data for margin control of a light are contained in the address (4008-400F) similarly. The data for margin control corresponding to various kinds of paper sizes are contained to the address (4087) below. And these data for margin control are used as set data of the counter for margin control in the printing data write control circuit 119 mentioned later.

[0062] Up to the address (4100 - 41FF), the table of the command code for assignment [ section / 2 / data control ] of operation is contained, and it is used for the command code check from the data control section 2. The contents of the command are the top / bottom margin modification table, the Top Margin adjustment table, a cassette top / preparations ready table, a cassette / manual bypass adjustment table, etc. Up to the address (4200 - 42FF), the data of the electrification property of a photoconductor drum 301 are contained, and five kinds of data of A-F are contained. And this data is used for temperature compensation control of the charger 304 for electrification mentioned later. Up to the address (4300 - 43FF), it is an exchange data table and each exchange cycle data of the developer in a photoconductor drum 301 and a development counter 307 and a fixing roller 332 is contained.

[0063] Up to the address (4400 - 47FF), the various timer values for being a timer table for control and performing printing actuation, such as each process timing and feed timing, are contained.

[0064] 106 is RAM (random access memory), it is the memory for working, and in it, as shown in drawing 46 , the contents of Timers (TIM) A, B, --, E, a paper size register (the cassette size data based on the signal of the cassette size pilot switch 320,324 mentioned later are memorized), the statuses 1-6, and others are contained. Said microprocessor 101 compares the cassette size memorized by the paper size register with the size of the recording information (image data etc.) from the external device sent from said data control section 2, and if the cassette size is larger, it will take out a printing operating command to the latter printing control section 100. Therefore, it can print, even if larger than the information size to which a print form is sent from the outside, and improvement in an availability can be aimed at. As for 107, it is held by the non-volatilized student RAM also at the time of power-source cutoff, as for the data in memory. Moreover, the contents of data in said non-volatilized student RAM are shown in drawing 45 . In drawing 45 , the drum property NO of having been inputted by exchange mode from the control unit is contained, the jam information at the time of jam generating is contained in the address (6100), and the address (6000) is used for prevention of a processing failure of jam paper inside the plane when a power source is once turned off at the time of a jam. The address (6200) is the paper output tray counter which counts the form in the reversal tray 381, and whenever one sheet of form is sent to the reversal tray 381, it is counted up every [ 1 ]. It is displayed on a control unit that this counted value will be in a tray full condition to reach to default value, and a form is picked out from a tray to an operator.

Moreover, this paper output tray counter will be automatically cleared, if a form is picked out from a tray by the operator. Therefore, even if a power source is turned off, the number of the forms which remain in the tray is held by this counter.

[0065] The address (6300) is a drum exchange counter and is counted up every [ per printing / 1 ]. When the value of this counter reaches the value of the exchange table (drum) of said drawing 45 , an operator is told about exchange of a drum by the display of a control unit.

[0066] The address (6400) is a developer exchange counter, is counted up every [ 1 ] for every printing like said drum exchange, and when the value of this counter reaches the value of the exchange table (developer) of said drawing 45 , it is displayed on a control unit.

[0067] The address (6500) is a fixing roller exchange counter, and it counts up every [ 1 ] for every printing like said drum exchange, and it is displayed on a control unit that the value of the exchange table (fixing roller) of drawing 45 is reached.

[0068] 108 is a power sequencing circuit and has the work which prevents the operation mistake at the time of the power source ON of said non-volatilized student RAM 107, or a power source OFF. 399 is a power unit which supplies the power source to a control section. 110 is input/output port and reads the output of the indicative data to the actuation display 111, each actuation switch data, etc. 112 is input port which reads the input data from each detector 113 in the printing control section 100. 116 shows driver elements, such as a motor, a high voltage power supply lamp, a solenoid, a fan, and a heater. 115 is the drive circuit of said driver element 116, and 114 is an output port which gives the output signal to said drive circuit 115. A laser scanning motor for 312 to operate a laser beam and 118 are the drive circuit, and 117 is input/output port which gives the drive control signal to said drive circuit.

[0069] The laser modulation circuit as a laser control unit which performs control whose 120 344 contains semiconductor laser and contains the light modulation of said semiconductor laser, and 346 are beam detectors which detect the light beam currently operated by said laser scanning motor, and the PIN diode which carries out a high-speed response is used. The high-speed comparator for 121 digitizing the analog signal from said beam detector, and making a horizontal synchronizing pulse and 119 are printing data write control circuits which perform control which writes the printing data of the video image transmitted from the data control section 2 in the position on a photo conductor 301, generating of test pattern printing data, etc. 122 is an interface circuitry which controls the receipt of the command data from the output of the status data to the data control section 2, and the data control section 2, and printing data etc.

[0070] Hereafter, the detail of the main blocks in drawing 13 is explained. Drawing 14 is the detail circuit diagram of the various detectors 113 in drawing 13 . In drawing 14 , the signal from various kinds of detectors is inputted into a multiplexer 139. In a multiplexer, it is inputted into the input port 112 of drawing 13 by the 8-bit signal S32 with a select signal S31.

[0071] 320 is an upper case cassette size pilot switch, consists of four switches and expresses paper size with those combination. 324 is a lower-berth cassette size pilot switch, and the configuration is the same as that of said upper case cassette size pilot switch. 319 is a cassette-upper-case-paper-less switch, and a switch will be turned on if paper is exhausted to a cassette. 323 is the paper-less switch of the lower berth. 123 is a

pass-before resist roller sensor, and the cds photo detector is used. Bias voltage is impressed through resistance (not shown) and, as for this sensor, output voltage changes with the existence of a form. Therefore, the signal which distinguishes the existence of a form is acquired by inputting into the comparator 124 with which the output is impressed to reference voltage Vref1.

[0072] The manual feed switch whose 326 detects the form from the manual bypass guide 325, the delivery switch which 336 has in the fixing roller section, and the delivery switch which 395 has in the paper output tray section are shown. The toner-less pilot switch to which 125 detects those without a toner in a toner box, and 126 show the toner back the toner full pilot switch which operates when a toner fills, respectively.

[0073] 127 is the detection sensor (probe concentration detection sensor) of the toner ratio concentration of a developer, and the photodiode is used. Bias voltage is impressed through resistance and, as for this sensor, output voltage changes with the concentration of a toner. Therefore, by inputting the output into a comparator 128, impression, now since it is, the signal of 1 or 0 is acquired [ reference voltage Vref2 ] for toner concentration by the input terminal of another side of a comparator 128 above default value or by the following, respectively.

[0074] The door switch which carries out ON/OFF of 129 by closing motion of a front cover, the temperature fuze by which 130 is prepared in the fixing assembly, and 131 are MC relays to which ON/OFF of the power source for a drive (+24VB) is carried out. Since one side of said temperature fuze 130 is connected to power-source +24VA, when the temperature fuze 130 melts by the abnormalities of a fixing assembly, said MC relay 131 is turned off and the power source for a drive is turned off. Moreover, the temperature fuze 130 is connected to resistance RO1, and one side of resistance RO1 is connected to the input of resistance RO2 and a comparator 132. Moreover, reference voltage Vref3 is impressed to other inputs of a comparator 132. Therefore, if the temperature fuze 130 melts, the input of a comparator 132 will be set to OV. Therefore, the fusing detecting signal of a temperature fuze is outputted to the output of a comparator 132. 133 is a destination change-over switch, by ON/OFF of this switch, ON condition serves as country turning inward (A and B size), and, specifically, OFF serves as \*\*\*\*\* (legal one, letter size). Even when it follows, for example, the combination of the code by the cassette size switch (four pieces) of said upper case or the lower berth is the same, according to the condition of this switch, the paper size of country turning inward / U.S. \*\*\*\*\* is chosen.

[0075] 134 is a jam reset switch and is installed in the front cover. This switch is a switch switch on in the sense of a check after an operator exchanges jam processing or a toner bag, when a paper jam or an operator tonerful of a call arises. Therefore, unless it turns on this switch after said processing, a jam or a control unit tonerful of a display is not cleared. 392 is a paper output tray sensor which detects the form in the tray in drawing 5 . 334 is the thermistor which detects the temperature of a fixing assembly, the detection temperature of this thermistor becomes fixed and appearance control of it is carried out. The output of a thermistor 334 is connected to the input side of resistance RO3 and a comparator 136,137. Therefore, the input voltage of a comparator changes in connection with the change in resistance by the temperature of a thermistor 334. That is, if temperature becomes high, the input voltage will become high. The electrical potential difference by which the partial pressure was carried out is impressed to the input terminal

of another side of a comparator 136 by resistance RO6 and RO7, and the output of a comparator 136 changes to it by whether it is higher than this reference voltage by which the partial pressure was carried out, or low. Moreover, resistance RO8 is connected at the node of resistance RO6 and RO7, and one of these is connected to the collector of a transistor 138. Therefore, if this transistor 138 turns on with an input signal (power save signal) S3, the reference voltage of a comparator 136 will become low by resistance RO8, and the temperature control of a fixing assembly will become lower than the time of the transistor 138 turning off. Therefore, the power consumption of a fixing assembly becomes low and will be in a power save condition. Moreover, the reference voltage of a comparator 137 is given with the partial pressure of resistance RO4 and RO5. And since the reference voltage of this comparator 137 is set up quite lower than the reference voltage of said comparator 136, a working heater open circuit of a printer or the temperature fall of the fixing assembly by failure of the drive circuit of a heater is detectable. And one side is inputted into the multiplexer 139 and the output S33 of a comparator 136 is read by the microprocessor 101. In addition, this input signal is used in the sense of detection of the ready state of a fixing assembly. Moreover, another side is used as a driving signal of the fixing assembly heater lamp 333 of drawing 15.

[0076] 342 is a drum thermo sensor which detects the temperature of the photo conductor 301 neighborhood. The output side of a thermistor 342 is connected to the input of resistance R58 and an operational amplifier 270. Therefore, the resistance of said thermistor 342 also changes with the temperature changes of the photo conductor 301 neighborhood. Therefore, the input voltage of an operational amplifier 270 also changes. When the output voltage of an operational amplifier 270 has the low temperature of a photo conductor 301, and the low battery of temperature is high, the high voltage is outputted, respectively. The operational amplifier 270 serves as a voltage follower, and the output is connected to the input of A/D converter 271. And the output voltage of said operational amplifier 270 is changed into digital value, and a microprocessor 101 is made to read through a multiplexer 139 by A/D converter 271. The temperature data of this photo conductor 301 by which A/D conversion was carried out are used for electrification amendment of the photo conductor 301 mentioned later. 440 is a cassette top / lower-berth adjustment switch, 441 is a cassette / manual bypass adjustment switch, and 442 is the Top Margin adjustment switch.

[0077] Drawing 15 is the detailed block diagram of the drive circuit 115 and the output component 116 in drawing 13. In drawing 15, 141 is a development counter motor and the hall motor of DC drive is used. 140 is the driver of said development counter motor, and is performing PLL control. 143 is a fixing assembly motor and the hall motor of DC drive is used. 142 is the driver of said fixing assembly motor 143, and is performing PLL control. 145 is a fan motor for cooling inside the plane, and the hall motor of DC drive is used. 144 is the driver of said cooling fan motor, and PLL speed control like the above-mentioned development counter and a fixing assembly driver is omitted. 147 is the motor for a drive of the photo conductor drum 301, and is using 4 phase pulse motor. 146 is the driver of said drum motor 147, and has adopted the constant current 1-2 phase excitation method. In addition, generating of vibration of 1200PPS extent is driving the rate in few parts. 149 is a pulse motor by the resist motor which makes the resist roller 329 and the manual bypass roller 327 drive. 148 is the driver of said resist motor and is using the constant-voltage 2 phase excitation method. A rate is 400PPS extent.

[0078] In addition, if a hand of cut is made normal rotation, the resist roller 329 rotates, and if it is made reversed, the manual bypass roller 327 will rotate the resist motor 149. These are transmitted through an one-way clutch.

[0079] 151 is a pulse motor by the feed motor which makes the lower-berth feeding roller 322 and the upper case feeding roller 318 drive. Forward and inverse rotation are transmitted through a one EUI clutch like the above. 150 is the driver of said feed motor 151, and is using constant-voltage 2 phase excitation like said resist Motor Driver 148. A rate is 400PPS extent.

[0080] Before electrification, 302 is an electric discharge lamp from which the residual charge on a photo conductor 301 is removed, and consists of two or more red LED. R10 is current control resistance of said electric discharge lamp 302, and 152 is the driver of the electric discharge lamp 302. 303 is a front [ imprint ] electric discharge lamp for gathering the imprint effectiveness set in front of the imprint charger, and consists of two or more red LED. R11 is current control resistance of said electric discharge lamp before an imprint, and 153 is the driver of said electric discharge lamp before an imprint. 158 is the solenoid of the blade for toner recovery, and a blade 310 will be pressed against a photo conductor 301 if this solenoid is turned on. 154 is DORABA of said blade solenoid 158. 159 is a toner supply motor for supplying a toner to a development counter 307 from a toner hopper, and when this toner supply motor rotates, it supplies a toner to a development counter 307 from said toner hopper. Actuation of this toner supply motor 159 operates according to the output of the probe concentration detection sensor of said drawing 14 . 155 is the driver of said toner supply motor 159. 131 is a MC relay which is interlocked with the same door switch as said drawing 14 , and works, and 156 is the driver. And as shown in drawing 15 , it connects with the contact 163 of the power-source side common \*\*\*\*\* MC relay 131 of the motor which excludes the MC relay 131, a lamp, etc., and another side of the contact is connected to +24VB power source. Therefore, when the MC relay 131 turns on, it has the composition that said motor and lamp can be operated.

[0081] 304 is a charger for electrification and the case of a charger is connected to the ground of an airframe. The wire for corona discharge of a charger is connected to the output terminal of the high voltage power supply 160 for electrification of a high voltage power supply 338, and the ON/OFF signal line S35 of a high-pressure output and the analog-control signal line S36 to which the high-pressure output current is changed are connected to the input of the high voltage power supply for electrification. Moreover, it connects with D/A converter 165, and the analog-control signal line S36 is analog-voltage-ized by D/A converter 165, and controls the output current of said high-voltage power source for electrification by the data of the electrification armature-voltage control data line S37 from a microprocessor 101. The charger for exfoliation and the exfoliation charger 306 are connected to the output of the high voltage power supply 161 for exfoliation for 306. Said high voltage power supply for exfoliation serves as AC output. The imprint charger for 305 to make a form imprinting the toner with which negatives were developed on the photo conductor 301, and the imprint charger are connected to the output of the high voltage power supply 62 for an imprint. Moreover, as for the high voltage power supply for an imprint, development counter bias power supply is also incorporated in addition to said imprint charger output, and the output line S38 is connected to the development counter magnet roller 308. With this electrical potential

difference, bias voltage is impressed to said magnet roller 308, and development bias is given. 33 is heater RAMBU of a fixing assembly, it connects with one side of the power source of AC100V, and one side is. Moreover, another side is connected to the 2nd contact 164 of the MC relay 131, and connection now a cage, and one of these are connected to the heater drive circuit 166. Therefore, the heater lamp 333 operates, only when said MC relay 131 is ON. Moreover, two input signals S33 and S39 are inputted into the heater drive circuit 166, and S33 is a signal from the thermistor 334 in a fixing assembly of said drawing 14 , and is the concentration control signal of a fixing assembly. S39 is the compulsive OFF signal of the heater lamp 333 from a microprocessor 101.

[0082] Drawing 16 is the laser scanning motor 312 in drawing 13 , and the detail circuit diagram of the drive circuit 118. In drawing 16 , 312 is a circuit diagram inside a laser scanning motor. L02, L03, and L04 show the coil of a motor, and 180,181,182 is a hall device which detects the location of the rotator of a motor, respectively. 183,184,185 is a comparator for said hall device 180,181,182, and the output is connected to the base of the power transistor 171,172,173 which drives said motor coils L02, L03, and L04 in the drive circuit 118 through resistance R26, R27, and R28. Moreover, between the base of said power transistor 171,172,173, and an emitter, base resistance R23, R24, and R25 is connected, respectively. Said hall device 180,181,182 is turned on in order of 180,181,182 with rotation of the rotator of a motor. Therefore, the output of a comparator 183,184,185 is also set to LOW level at the order of 183,184,185. Therefore, the laser scan motor 312 rotates by turning on a power transistor at the order of 173,172,171, and impressing driver voltage in order of L02, L03, and L04. Moreover, the output of a comparator 185 lets diode D02 pass, and is inputted into the dividing counter 175 through the waveform shaping circuit by resistance R30 and the capacitor C06, and the inverter 174. The output of the outgoing ends Q1 and Q2 of the dividing counter 175 is connected to the motor-velocity change-over gate 176,177, and the output of said speed change-over gate is connected to FG input of the PLL (phase . lock . loop formation) control IC through the OR gate 178. Moreover, the output and its reversal output of the speed control signal line S40 are connected to one input of said speed change-over gate 176,177. Therefore, when S40 is LOW level, the change-over gate 177 becomes effective, the output of Q1 of a dividing counter is inputted into FG of said PLL control IC 167, when S40 is HIGH level, the change-over gate 176 becomes effective, and 175Qdividing counter 2 output is inputted into FG input of the PLL control IC 167. If the I/O signal of the PLL control IC 167 is explained briefly here, a P/S terminal (PLAY/STOP) will be stopped on HIGH level, and will be started on LOW level. In the case of HIGH level, the both-ends child paragenesis force of AGC and APC serves as HIGH level. When the Xtal criteria dividing output signal and CPIN have in a reference frequency input by the lock detecting signal and the rotary motor pulse signal input from the motor which FGIN controls, the signal with which N1 and N2 switch the number of dividing of the criteria counting-down circuit inside this IC, and 33/45 have LD in rotational frequency's of motor lock within the limits, as for the change-over signal of the rotational frequency of a motor, and CPOUT, HIGH level is outputted, and LOW level is outputted except it. In the speed-control system output of a motor, AFC is a 8-bit D/A converter output inside PLLIC, and APC is a 8-bit D/A converter output inside PLLIC with the phase control system output of a motor. Moreover, the quartz resonator for

reference frequency generating in X01 connected to PLLIC167, and C01 and C02 are the capacitors for an oscillation.

[0083] AFC of IC167 for PLL control and the output terminal of APC constitute an adder circuit from resistance R12 and R13, and are connected to - side input terminal of an operational amplifier 168. The electrical potential difference which pressured +12V partially by resistance R14 and R15 is impressed to + side input terminal of an operational amplifier 168. Moreover, the negative feedback circuit is constituted from resistance R16 and a capacitor C03, and especially the capacitor C03 carries out the duty of a high-pass filter. Therefore, the amplification degree of an operational amplifier 168 has given the property to decrease to the input more than a certain frequency. The output of an operational amplifier 168 is connected to + input terminal of the servovalve switching regulator IC 169. 169 is the servovalve switching regulator IC of a common commercial item. The down switching regulator circuit consists of a book IC 169, and a power transistor 170, diode D01, a coil L01 and a capacitor C05. In I/O of IC169, - terminal is a comparison reference voltage terminal, and the reference voltage which pressured partially the electrical potential difference of the reference voltage output terminal VREF of the IC169 interior by resistance R17 and R18 is impressed. A DEADTIME terminal regulates the greatest pulse width of an output, and the electrical potential difference which pressured said VREF partially by resistance R19 and R20 is impressed. C1 and C2 are output terminals, and pulse width changes according to the electrical-potential-difference value of + input terminal. That is, if + side input terminal electrical potential difference is lower than - side input terminal electrical potential difference, the pulse width by the side of the LOW level of C1 and C2 will become small, and the width of face which a power transistor 170 turns on will become small similarly. Therefore, the both-ends electrical potential difference of a capacitor C05 also becomes small. Moreover, if + side input terminal electrical potential difference is higher than - side input terminal electrical potential difference, contrary to the above, the pulse width of C1 and C2 will become large, and the both-ends electrical potential difference of a capacitor C05 will also become large.

[0084] The revolving speed control of the scanning motor 312 is explained below.

[0085] Since AFC of IC167 for PLL control and both the outputs of APC serve as LOW level until the above-mentioned lock signal S41 is outputted if the rotation start signal S42 of the scanning motor 312 is set to LOW level, as for the output of an operational amplifier 168, the electrical potential difference of HIGH level is outputted. Therefore, in the output pulse width of face of a regulator IC 169, the both-ends electrical potential difference of the large next door capacitor C05 becomes about abbreviation +16V. And since any one of said the hall devices 180,181,182 is turned on in the location which the rotator of a motor has stopped, the coil corresponding to said hall device 180,181,182 is excited among the motor coils L02, L03, and L04, and, as for the scanning motor 312, rotation is begun. And the scanning motor 312 brings rotation forward and goes. Now, since the level of the speed control signal line S40 is HIGH, 175Qdividing counter 2 output is applied to FG input terminal of the PLL control IC 167. Therefore, the dividing counter 175 is working as eight frequency dividers. When the frequency of the signal added to FGIN reaches about 96% of the reference frequency of the PLLIC169 interior, it is the lock signal LD. S41 is set to HIGH and AFC and an APC output level switch to the output voltage of the interior D/A converter of PLLIC instead of LOW level (OV)



immobilization. Therefore, the scanning motor 312 becomes a fixed speed and appearance control is carried out by the speed-control system output AFC and the phase control system output APC henceforth.

[0086] Moreover, when the command of a fixed time amount (about 5 minutes) print which is this example does not come from the data control section 2, a scanning motor will be in a standby condition and the output of the speed control line S40 will be set to LOW level. Therefore, since a counting-down circuit 175 serves as 4 dividing from 8 front dividing, a scanning motor becomes the rotational frequency of  $4/8$ ,  $1/2$  [ i.e., ]. When long duration high-speed rotation is being performed, in order for this to prevent integrity problems, such as bearing of a motor, occurring, it is performing the above half-speed control. In addition, in this example, it is about 12,000 rpm at the time of printing actuation, i.e., high-speed rotation, and is about 6000 rpm at the time of standby.

[0087] Drawing 17 is the detail circuit diagram of the laser modulation circuit 120 and semiconductor laser 344 in drawing 13 . In drawing 17 , the configuration consists of the laser diode 259 which emits light, and the photodiode 260 for monitors which is the photodetection means which acts as the monitor of the output beam reinforcement from laser diode 259 with the light beam generating means slack semi-conductor laser diode whose 344 is a light beam generating means. 257 performs light modulation of laser diode 259 with the transistor for high frequency which is a voltage-current conversion means (or 1st current driving means) (control means). As for a (level selection means) and R51, the current-limiting resistance and R52 are base current-limiting resistance of a transistor 258 with the transistor which is the 2nd current driving means for resistance R50 to pass the resistance for current detection to a laser diode 259, and for 258 pass a bias current. 254,255,256 is a high-speed analog switch for giving a modulation to a laser diode 259, between a drain (D) and the source (S) serves as low resistance, and each analog switch will be in ON condition, if the electrical potential difference of HIGH level is impressed to the gate (G). If the electrical potential difference of LOW level is impressed to the gate (G), it becomes high resistance conversely and will be in an OFF condition. In the case of this laser beam printer, the output power from laser 259 has three level. Laser diode 259 is set to said output P (ON) by turning on an analog switch 254 by output [ for the 1st to remove nearly completely the charge with which the photo conductor 301 was charged in the part equivalent to the white ground on a form ] P (ON). The 2nd is a part equivalent to the black material on a form, since the charge with which it was charged on the photo conductor 301 is left as it is, it is in the output "0" condition (OFF) P, i.e., an output, and laser diode 259 serves as outputs OFF and P (OFF) by turning on an analog switch 256. The 3rd is for raising the printing concentration of 1-dot Rhine by the said 1st output P (ON) and output [ during the 2nd output P (OFF) ] P (SH), and laser diode 259 is set to said output P (SH) by turning on an analog switch 255 (about the detail of P (SH), it mentions later).

[0088] Resistance R42 and R43 is the short circuit protective resistance at the time of ON/OFF change of an analog switch 254,255,256, and 249,250,251 is the gate driver of said analog switch 254,255,256. As for C09, C10, and C11, the capacitor for speedup, and R47, R48 and R49 are the input resistance of said gate driver 249,250,251.

[0089] When, as for 246, all the three gate inputs are set to HIGH level in 3 NAND gates, an output is set to LOW level, said analog switch 254 is turned ON and laser diode 259 will be in a said output P (ON) condition. The 1st is connected to the output of an inverter

253 among the three input gates, and the input of an inverter 253 is connected to the printing data signal S47 (it does not print on the LOW level printed on HIGH level). The 2nd is connected to the output of an inverter 252, and the input of an inverter 252 is connected to the shadow signal S48 (off on HIGH level at shadow-on and LOW). The 3rd is connected to the laser enable signal S49 (it is the laser compulsion OFF at laser enabling and LOW in HIGH level). Therefore, the laser enable signal S49 of the conditions from which the output of said NAND gate 246 is set to LOW level is a time of HIGH and the shadow signal S48 being [ LOW and the printing data signal S47 ] LOW(s). Next, when, as for 247, all the three gate inputs are set to HIGH level in 3 NAND gates, an output is set to LOW level, said analog switch 255 is turned ON and laser diode 259 will be in a said output P (SH) condition. The 3rd is connected to said shadow signal S48 among [ 1st ] the three input gates at the output of the inverter 253 the 2nd [ whose ] is the reversal signal of said printing data signal S47 at said laser enable signal S49, respectively. Therefore, the laser enable signal S49 of the conditions from which the output of said NAND gate 247 is set to LOW level is a time of HIGH and the shadow signal S48 being [ HIGH and the printing data signal S47 ] LOW(s). Next, 248 is 2 OR gates, if one of gate inputs are set to LOW level between two gate inputs, an output is set to LOW level, said analog switch 256 is turned ON and laser diode 259 will be in an OFF status-out-put P (OFF) condition.

[0090] 245 is a sample and Hold IC, and it is used in order to control the output of laser diode 259 to said shadow output P (SH). The analog voltage input and SAMPLEC which carry out the sample of ANALOG-INPUT are the strobe signal terminal of a sampling, and the connection terminal of the capacitor CO 8 for a hold and STROBE are connected to the sample strobe signal S46. 237 is the operational amplifier of an FET input and constitutes the voltage follower circuit. DO3 is regulated so that the output of laser diode 259 may become within the maximum rating for TSUENA diode. Moreover, the integrating circuit as an integral means is constituted from resistance R40 and a capacitor CO 7, and resistance R41 is resistance for discharge which makes the charge of said capacitor CO 7 discharge at a fixed rate. 236 is an analog switch as a switching means, the gate (G) is connected to the buffer 244, and the sample signal S45 is inputted into the input of a buffer 244. The transistor for level conversions and R39 commit 253 as current-limiting resistance at the time of the charge to said capacitor CO 7. It is the comparator whose R38 is base current-limiting resistance of a transistor 235 and whose 234 is a comparison means, and this comparator has given the hysteresis characteristic by work of resistance R34 and R35. The output voltage of the laser monitoring amplifier 232 is impressed to + input side of a comparator 234 through said resistance R34. 232 is the amplifier of the output of the photodiode 260 which detects the optical output from laser diode 259, and is offered as a current-electrical-potential-difference conversion means. Resistance R32, R33, and VRO1 is resistance which regulates the amplification degree of said operational amplifier 232. Therefore, the amplification degree of an operational amplifier 232 can be changed by changing volume VRO1. R31 is the load resistance for an output of the photodiode 260 in said semiconductor laser 344, and the electrical potential difference proportional to the output current of a photodiode 260 is obtained. Drawing 19 shows the relation of the short-circuit current  $I_s$  over the optical output  $P_o$  of a photodiode 260. In drawing 19,  $I_s$  shows a monitor current and  $P_o$  shows the optical output of laser diode 259. said output of P (ON) -- about 6 -- the output of mw(s) and P

(SH) -- about 4 -- P (OFF) is mw(s) and 0. Moreover, LA-A and LA-B express the monitor property of two kinds of laser diodes. Usually, said volume VR 01 is adjusted so that the output voltage of an operational amplifier 232 may become [ a laser diode optical output ] about 3V at the time of 6mw(s). Therefore, said volume VR 01 can adjust now in both of the properties, graph LA-A of drawing 19 , and LA-B. 238 is a comparator which checks whether laser diode 259 is emitting light, and the output voltage of said operational amplifier 232 is impressed to + side input. Moreover, a partial pressure is carried out to - side by resistance R36 and R37, and the electrical potential difference (it is set as abbreviation 2.0V in this case) is impressed. Therefore, a laser diode 259 emits light, as for about 2 mw bell, the output changes from LOW level to HIGH level, and the laser ready signal S43 is outputted. Moreover, the quantity of light programmed voltage of laser is impressed to - side input terminal of said comparator 234. Said programmed voltage is given from either an analog switch 240 or 241. That is, an analog switch 240 serves as ON at the time of a setup of said laser output P (ON), and the output voltage of the voltage follower 239 is impressed to - side input of said comparator 234. A partial pressure is carried out to the Maine exposure adjustment volume 360 which is the 1st electrical-potential-difference adjustable means by resistance R45, the electrical potential difference is inputted, and the electrical potential difference of - side edge child of a comparator 234 also changes to the input terminal of the voltage follower 239 by carrying out adjustable [ of said Maine exposure adjustment volume 360 ]. Moreover, an analog switch 241 serves as ON at the time of a setup of said laser output P (SH), and the electrical potential difference the partial pressure was carried out [ the electrical potential difference ] to resistance R46 by the shadow exposure adjustment volume 361 which is the 2nd electrical-potential-difference adjustable means is given to - side input terminal of said comparator 234 in the output voltage of said voltage follower 239. The optical output setting means consists of the above-mentioned voltage follower 239, an analog switch 240,241, the Maine exposure adjustment volume 360, resistance R45, shadow exposure adjustment volume 361, and resistance R46. Moreover, the circuit which integrates a comparator 234 with the compound value for the electrical potential difference which was detected by the photodiode 260 for monitors and amplified with monitoring amplifier 324 as compared with a programmed voltage is called an optical output stabilization means.

[0091] And a change-over of said analog switch 240,241 is switched by the Maine exposure setting signal S44. That is, when said Maine exposure setting signal S44 is LOW level, the output level of an inverter 242 turns into HIGH level, and an analog switch 241 turns on. Moreover, when said Maine exposure setting signal S44 is HIGH level, the output of a buffer 243 is set to HIGH level, and an analog switch 240 turns on. Moreover, the output S50 of said voltage follower 261 is used for amendment of the threshold level of the horizontal synchronizing pulse detection comparator of the beam detector which the output (S side) of an analog switch 240,241 is inputted also into the voltage follower 261, and is mentioned later.

[0092] Next, the current-output characteristics of the laser diode currently used by this printer are explained. Drawing 18 is the graph of the IF-Po property. TC=0 degree C -- a case-temperature o'clock [ of laser diode 344 / the o'clock of 0 degree C ] IF-Po property -- similarly, TC=25 degree C is case-temperature the o'clock of 25 degrees C, and TC=50 degree C is a case-temperature 50-degree-C o'clock IF-Po property. If the sequential

increment of the current  $I_F$  which will be passed to laser diode 259 if a case-temperature  $T_C=25$  degree C property is taken for an example is carried out from 0, an optical output  $P_o$  will begin to be outputted from about 50mA point. And it is set to 6mw(s) which are said optical outputs of P (ON) on the  $I_F=68$ mA point. Therefore, by turning on said transistor 258, since it is the about 40mA point that an optical output  $P_o$  begins to be outputted also by the case of  $T_C=0$  degree C, when said laser enable signal S49 is HIGH level, power loss of a sink and said transistor 257 for a laser modulation is always lessened for a bias current  $I_{FB}$ . Therefore, the actuation in which the transistor 257 for a laser modulation has stability extremely also in the time of an elevated temperature according to an operation of said bias current  $I_{FB}$  is guaranteed. Moreover, in the case of  $T_C=25$  degree C, the value of  $I_{F25}-I_{FB}$  is sufficient as the variation of a current required to modulate laser, and it can improve considerably precision of the quantity of light stabilization actuation later mentioned compared with driving the current of  $I_{F25}$  with the direct transistor 257. Moreover, since an output changes with temperature considerably as a property of the laser diode itself so that clearly also from a graph, said quantity of light stabilization circuit is needed. This laser intensity stabilization circuit is controlled so that the monitor photodiode 260 detects the quantity of light from laser diode 259 and the short-circuit current  $I_s$  of the photodiode 260 always becomes a constant rate. Because, whenever it keeps a monitor current  $I_s$  constant since the optical output  $P_o$  of the monitor short-circuit current  $I_s$  and laser diode 259 is in perfect proportionality so that clearly also from drawing 19 , an optical output  $P_o$  will be kept constant. Moreover, since the drift by the temperature of a photodiode 260 is also very small, even if temperature changes, the variation of an optical output can be disregarded. Next, actuation of an above-mentioned optical output stabilization circuit is explained using drawing 17 and drawing 20 .

[0093] If both the laser enable signal S49 and the sample signal S45 are set to HIGH level in drawing 20 , the transistor 258 of drawing 17 will be turned on and a bias current (about 30mA) will flow to a laser diode 259 through resistance R51. Moreover, at this time, since both the printing data signal S47 and the shadow signal S48 serve as LOW level, among the gates 246,247,248, since all inputs serve as HIGH level, as for an output, only the gate 246 is set to LOW level, and an analog switch 254 will be in ON condition among analog switches 254,255,256. Moreover, when the sample signal S45 is set to HIGH, an analog switch 236 serves as ON. At this time, the output of the OPEA amplifier 237 serves as OV for the condition that the capacitor CO 7 is not charged, and the base of the transistor 257 for a laser modulation also still serves as OV. Therefore, at this time, a laser diode does not emit light so that only said bias current may flow to the laser diode 249 and the property of drawing 18 may also show. Since laser is not emitting light to the photodiode 260 for monitors of laser diode, the monitor current  $I_s$  is 0, since, as for the output of the OPEA amplifier 232, OV is outputted, the output of a comparator 234 serves as LOW level, and a transistor 235 will be in an OFF condition. Since a transistor 235 is OFF, said capacitor C07 is charged through resistance R39 and R40. These resistance R39 and R40 when being charged and the time constant of a capacitor CO 7 are chosen as 20 - 50msec extent. If this value is very small, the responsibility of a stabilization circuit will be too early and fluctuation of the optical output level of laser will become large. If not much large again, that responsibility worsens and an optical output is stabilized will take time amount. The output voltage of a voltage follower 237 also rises gradually by performing charge to said capacitor CO 7. Therefore, according to

the base electrical potential difference of tolan JISHITA 257 for a laser modulation rising, a current flows to a collector. The collector current  $I_c$  of the transistor 257 at this time serves as  $\{V_B - V_{BE} (SAT)\} / \text{current value of } R_{50}$ . To a laser diode 259, the addition current  $I_F$  of the bias current  $I_{FB}$  from said transistor 258 and the current  $I_c$  from said transistor 257 flows. And Current  $I_c$  increases, and if the forward current  $I_F$  of laser diode 259 amounts to about 50mA ( $T_C=25$  degree C), laser diode 259 will emit light. When laser diode 259 emits light, by flowing according to the optical output to which the monitor current of said photodiode 260 for monitors emitted light, + input terminal electrical potential difference of an operational amplifier 232 rises, and the value to which the output voltage also amplified input voltage is outputted. and the amplification degree of an operational amplifier 232 -- output 1mw of laser diode 259 -- receiving -- the output voltage of an operational amplifier 232 -- about 0.5 -- since it is beforehand adjusted by volume VR 01 so that it may be set to V -- the optical output of laser diode 259 -- increasing -- the output voltage of about 2 mw(s) and an operational amplifier 232 -- about 1 -- if set to V, it will change from LOW to HIGH level, the output signal S43, i.e., the laser ready signal, of a comparator 238. And since the Maine exposure setting signal S44 is LOW level, the shadow exposure level (optical output P (SH)) electrical potential difference is impressed to - side input terminal of a comparator 234 through the analog switch 241. According to the sensibility property of a photo conductor 301, the shadow exposure level electrical potential difference is set up for this electrical potential difference by the shadow exposure setting volume 361 in a control unit. Suppose that it is electrical-potential-difference 2.0V which is equivalent to optical output 4mw which is an average value now. Therefore, if the optical output of laser diode 259 goes up and + input terminal electrical potential difference of a comparator 234 becomes more than 2.0V, a transistor 235 will be turned on and the discharge of the capacitor CO 7 will be carried out through resistance R40. Therefore, the base electrical potential difference of the transistor 257 for a laser modulation also descends, and the optical output of laser diode 259 is set to 4 or less mws. If the optical output of laser diode 259 is set to 4 or less mws, + side input terminal electrical potential difference of a comparator 234 also becomes less than [ 2.0V ], and a transistor 235 turns it off again. And the charge up of the capacitor CO 7 is again carried out through resistance R39 and R40. If it does so, when changing laser diode 259 centering on near 4mw in an optical output again, a comparator 234 will repeat actuation of ON/OFF a fixed period. In addition, since this comparator 234 has the hysteresis characteristic, a comparative judgment can stabilize it, and it can make a positive judgment. And according to the storage effect by said resistance R39 and R40, the both-ends electrical potential difference of a capacitor CO 7 approaches the value of VO1 of drawing 20 , and is stabilized. And after said laser ready signal S43 is set to HIGH level, a microprocessor 101 outputs the sample strobe signal S46 of shadow level after predetermined time  $t_6$  progress through an output port. If a sample strobe signal is outputted, sample hold IC 245 will carry out sample hold of the electrical potential difference VO1 ( drawing 20 ) of the capacitor C07 inputted into the ANALOG-INPUT input terminal, and will memorize the electrical potential difference to the capacitor CO 8 for a hold. Therefore, the control voltage VO1 for making said shadow level P (SH) output to the output OUT of the back sample hold IC with which the sample strobe signal was turned off continues being outputted.

[0094] Next, after sample hold actuation of shadow level P (SH) is completed, a microprocessor 101 switches the Maine exposure setting signal S44 to HIGH level through an output port. Therefore, the output voltage of the voltage follower 239 is impressed to - side input terminal of a comparator 234 through an analog switch 240. The Maine exposure level (optical output P (ON)) electrical potential difference is outputted to the output of the voltage follower 239. Electrical-potential-difference 3.0V equivalent to optical output 6mw which this electrical potential difference is an electrical potential difference set up by the Maine exposure setting volume 360 in a control unit according to the sensibility property of a photo conductor 301, and is a now average value shall be outputted. Therefore, the output of a comparator 234 is set to LOW level when - side input terminal switched to 3.0V, and a transistor 235 will be in an OFF condition. Therefore, by carrying out the charge up further, the base electrical potential difference of the transistor for a laser modulation also rises, and the optical output of laser diode 259 also increases a capacitor CO 7. And if the optical output of laser diode 259 becomes near 6mw, the output voltage V232 of an operational amplifier 232 will be set to about 3 V. If the output voltage of an operational amplifier 232 becomes more than 3V, like the time of the above-mentioned shadow level setting, the output of a comparator 234 will change to HIGH, a transistor 235 will be turned on, and the discharge of the capacitor CO 7 will be carried out through resistance R40. Therefore, the base electrical potential difference of the transistor 257 for a laser modulation also descends, and the optical output of laser diode 259 is set to 6 or less mws. If the optical output of laser diode 259 is set to 6 or less mws, + side input terminal electrical potential difference of a comparator 234 also becomes less than [ 3.0V ], and a transistor 235 turns it off again. And again, the charge up of the capacitor CO 7 is carried out through resistance R39 and R40, and the optical output of laser diode 259 is set to 6 or more mws. Thus, as for a comparator 234, the optical output of laser diode 259 repeats actuation of ON/OFF a fixed period centering on near 6mw. And according to the storage effect by said resistance R39 and R40, the electrical potential difference of a capacitor CO 7 approaches drawing 20 VO2, and is stabilized. And after a setup of said Maine exposure level is completed, a microprocessor 101 makes actuation of the sampling timer mentioned later start, and performs write-in actuation to the photo conductor 301 of printing data. The trigger of the sample timer is carried out one after another the period T fixed whenever the laser-beam detecting signal mentioned later comes, and parts other than write-in actuation of said printing data, i.e., the section of drawing 20 a, output the sampling signal S45. And in the section of the printing data S47 and the shadow data S48, since it has LOW level, the sample signal S45 turns off an analog switch 236. Therefore, laser diode 259 becomes three level, P (ON), P (SH), and P (OFF), with the printing data D47 and the shadow signal S48 in the printing area modulated at the appearance which mentioned above the level of the optical output of laser diode 259. That is, NAND gate 246 is materialized in the case (as output of printing, it is white) where the printing data signal S47 is [ a shadow signal ] OFF, i.e., LOW level, in OFF, i.e., LOW level, as for the 1st, only an analog switch 254 serves as ON, the Maine exposure level electrical potential difference V02 is impressed to the base of the transistor 257 for a modulation, and the optical output of laser diode 259 serves as P(ON) =6mw. NAND gate 247 is materialized in the case (as output of printing, it is a halftone) where the printing data signals S47 are [ OFF and a shadow signal ] ON, as for the 2nd, only an analog switch 255 serves as ON, the output

voltage V01 of said sample hold IC 245 is impressed to the base of the transistor 257 for a modulation, and the optical output of laser diode 259 serves as P(SH) = 4mw. The printing data signal S47 is the case (as output of printing, it is black) where ON and a shadow signal are OFF, the OR gate 248 is materialized and, as for the 3rd, only an analog switch 256 serves as ON. Therefore, since the base of the transistor 257 for a modulation is shot to GND and serves as OV, the optical output of laser diode 259 is set to P(OFF) = 0, and does not emit light. Thus, 1st printing is performed. And after printing is completed, a microprocessor 101 makes LOW level again the Maine exposure setting signal S44 through an output port, and resets shadow exposure level P (SH). Therefore, the electrical potential difference of - side input terminal of a comparator 234 is set to 2.0V which are the programmed voltage of shadow exposure level. Therefore, a transistor 235 serves as ON, the discharge of the capacitor CO 7 is carried out, and VCO7 becomes small. When explaining optical output stabilization actuation of laser diode here, only in  $\Delta T$ , at the time of the 2nd printing actuation, the case temperature of laser diode 344 should rise temporarily. When case temperature rose, the IF-Po characteristic curve of laser diode is shifted to right-hand side and the same current is passed to laser diode 259 so that clearly also from the property Fig. of drawing 18, an optical output Po will decrease. Therefore, in order to obtain the same optical output, only the current  $\Delta I_F$  of the part from which the characteristic curve shifted IF to right-hand side must make it increase. Therefore, it is set as V03 only with the electrical potential difference  $\Delta V_1$  higher than the 1st programmed voltage V01 equivalent to the aforementioned  $\Delta I_F$ , and, for the optical output of laser diode 259, the electrical potential difference VCO 7 of a capacitor CO 7 is \*\* to the same P(SH) = 4mw as the 1st setup. A law is carried out. And a setup of said shadow exposure level P (ON) is performed to sample hold IC 245 by the sample strobe signal S46 like the 1st time. Also at this time, it becomes the actuation corresponding to a case-temperature rise of a laser diode 344, and the electrical potential difference of a capacitor C07 is set as V04 only with the high correction voltage  $\Delta V_2$  by the temperature rise, and 2nd printing is performed after a setup. Thus, shadow exposure level P (SH) and Maine exposure level P (ON) can print high quality, when being held very correctly by work of a stabilization circuit at fixed level. In addition, Maine exposure level P (ON) is making quantity of light stabilization actuation perform so that an optical output may always be kept [ be / it / under / printing data write-in / removing ] constant, as mentioned above. Moreover, sample hold actuation is made to perform before printing initiation of each printing about shadow exposure level, and the quantity of light stabilization actuation under printing write-in actuation is not made to perform like the Maine exposure level. It is for not affecting a quality of printed character so much, even if shadow level is auxiliary and it changes somewhat compared with fluctuation of that a circuit becomes complicated and this becomes expensive and the Maine exposure level. In addition, in carrying out adjustable [ of the programmed voltage inputted into a comparator 234 according to the sensibility property of a photo conductor 201 ], adjustable [ of said Maine exposure setting volume 360 ] is carried out, and it adjusts it. This Maine exposure setting volume 360 carries out adjustable [ of the input voltage of the voltage follower 239 ]. Therefore, adjustable [ of this Maine exposure setting volume 360 ] can adjust the optical output programmed voltage at the time of P (ON). On the other hand, the optical output programmed voltage at the time of P (SH) pressures partially the output voltage of said voltage follower 239 in resistance R46 and

the shadow exposure setting volume 361. Therefore, by adjusting said Maine exposure setting volume 360, at the time of P (ON), the optical output programmed voltage at the time of P (SH) will change-like proportionally, and can maintain the fixed relation between record concentration and applied voltage. Therefore, like before, at the time of P (ON), complicated actuation of carrying out adjustable [ of both the programmed voltages at the time of P (SH) ], and adjusting them is not required, but adjustment becomes simple.

[0095] Drawing 21 is the detail circuit diagram of the beam detector 121 and the beam detector 346 in drawing 13. In drawing 21, 346 is a beam detector and is using the very quick PIN diode of responsibility. Moreover, this beam detector 346 must serve as a reference pulse when writing printing data in a photo conductor 301, as shown in drawing 3, and that pulse width and its generating location of a pulse must be very exact. Therefore, if pulse width, the generating location of a pulse, etc. are changed for every beam scan by rotation of the polygon mirror 313, the write-in start point on a photo conductor 301 will be changed, and a quality of printed character will worsen. The anode side of the beam detector 346 is connected to - side input terminal of the high-speed comparator 262 which is a comparison means through load resistance R52 and resistance R55. Moreover, the electrical potential difference by which the partial pressure was carried out is impressed to + side input terminal of a comparator 262 through resistance R56 by resistance R53 and R54. Moreover, the capacitor C12 for noise rejection is connected to juxtaposition at resistance R54. Moreover, the resistance for POJITIBU feedback for R57 to give a hysteresis characteristic and C13 are the capacitors for feedback for applying feedback at high speed and making an output wave improve. Moreover, the threshold adjustable electrical potential difference S50 is impressed to + side input of a comparator 262 through diode D40 and resistance R57. This threshold adjustable electrical potential difference S50 is the output (output of an optical output setting means) of said analog switch 240 or an analog switch 241 (refer to drawing 17). The relation between - side edge child input wave of a comparator 262, i.e., the output wave of the beam detector 346, and + side edge child electrical potential difference of a comparator 262 and relation with the output wave of the comparator 262 at that time are shown in drawing 22. If a laser beam passes through the beam detector 346 top at high speed, from a beam detector (PIN diode), pulse current will flow and the wave of a of drawing 22 and b will be inputted into - side input terminal of a comparator 262. Now, since the threshold adjustable electrical potential difference S50 was not impressed for the electrical potential difference of + side input terminal of a comparator 262, supposing the always low electrical potential difference V06 was impressed, in Wave a, the output wave of a comparator 262 will turn into an output wave as shown in a dotted line, and, in Wave b, it will become the output wave shown as a continuous line. As for Wave b, Wave a shows the time of a laser output being 6 or less mws in the case where the sensibility of a photo conductor is conversely high here, when the laser output at the time of said Maine exposure is 6 or more mws in the case where the sensibility of a photo conductor 301 is low. When + side electrical potential difference of a comparator 262 is fixed so that this output wave may also show, an output wave will change with the quantity of lights by which incidence is carried out to the beam detector 346 sharply. then, by amending so that it may become the electrical potential difference of V06 using the threshold adjustable electrical potential difference S50, when the quantity of light of a



laser beam is large and it is small on the electrical potential difference of V05, as shown in drawing 22 , the output wave can be maintained at about 1 law.

[0096] Drawing 23 is the block diagram of said beam detector (PIN diode) 346. drawing 23 -- setting -- 410 -- in a mask plate and 413, a laser scanning beam and 414 show the photo detector attachment base, and, as for a photo detector and 411, 415 shows [ an electrode line and 412 ] output lead wire, respectively. The PIN diodes currently used for this example are the photo detector configuration of 2.5x2.5mm, and the thing of 4ns of response times. The laser beam 413 is scanned in the direction of an arrow head of drawing 23 at the fixed rate by rotation of the polygon mirror 313. And if said laser beam 413 passes through said photo detector 410 top, the output current will flow according to the optical output of the laser beam 413. At this time, the input wave of - side input terminal of the comparator 262 of drawing 21 turns into a wave shown in drawing 24 . drawing 24 -- an input wave -- the noise has generated 1 before and after a wave in case there is no mask on said photo detector 410, and an output wave. This is mainly targeting the case where it is used for detection of the light of a rate very late even when the light in which photo detector 410 the very thing is originally standing it still is detected or scanned, there are quite many components with the bad parallelism of the end face of a photo detector 410, when said laser beam passes the end face, the output current becomes unstable and it generates it. Therefore, in order to solve such faults, the output wave crack at the time of the beam passage on said end face is prevented by attaching the mask 412 which does not pass a laser beam 413 on the light-receiving side of said photo detector 410. Said mask 412 is made into the structure which opened the aperture of four angles in the part which does not contain a part for an edge surface part and the electrode line 411 cash-drawer part of a photo detector 410 as shown in drawing 23 , and only when said laser beam 413 has passed the part of the aperture of the four angles, he is trying for light to be equivalent to said photo detector 410. raising the precision, especially parallelism for a window part of said mask with such structure -- the input wave to said comparator 262 -- the input wave of drawing 24 -- the wave which does not contain a noise like 2 is acquired.

[0097] Drawing 25 is the detail circuit diagram of the printing data write control circuit 119 in drawing 13 . Serial conversion of said parallel printing data S57 is carried out in order to write in the area on the predetermined photo conductor 301 according to the size of the form which makes the printing data S57 from an interface circuitry 122 print as main functions of this printing data write control circuit 119, and it sends out to the laser modulation circuit 120. Moreover, the generation of the shadow signal for raising a quality of printed character from the contents of data of said printing data S57 is carried out, and it sends out to the laser modulation circuit 120 with printing data. Moreover, a signal required at the time of an optical output setup is sent out in the laser modulation circuit 120. Moreover, the timing signal for controlling sending out from the printing data control section 2 to an interface circuitry 122 is sent out. Another carries out the generation of the pattern of test printing required for a maintenance.

[0098] Input/output port for 186 to perform sending out of a signal required for control in the laser modulation circuit 120 and the printing data write control circuit 119, reception, etc. in drawing 25 and 187,188 are the counter/timer which controls control of the write-in location of printing data, test pattern generating, a laser optical output sampling, etc. 189 becomes the reference clock of an image clock pulse with a crystal oscillator, and an

oscillation frequency is about 32MHz. 190 generates the pulse (about 8MHz) which corresponds 1 dot per the minimum modulation of a laser beam in the circuit which generates an image clock. A sequence control counter for 191 to carry out serial conversion of the printing data of a cutting tool unit (8 bits) received from an interface circuitry, The circuit which generates the test pattern which uses 192 at the time of a maintenance, the multiplexer to which 211 performs selection with test pattern data and the printing data from an interface circuitry 122, The shift register from which 210 changes serially the 8-bit parallel data from said multiplexer 211, The address counter for [ memory capacity ] said Rhine memory 213,214 in 4096 bits and 212 and 215 are the decoders for making the signal which controls said test pattern generating circuit by the Rhine memory by which 213,214 stores printing data temporarily. 226,227,228 is a flip-flop for doubling printing data and shadow data forwarding timing.

[0099] The detail of said counter 187,188 is explained here. It is the counter which determines the timing for laser intensity amendment of every Rhine (horizontal scanning line), a count is performed based on the reference clock signal S53, and 275 generates the sample signal S75 used for the object for quantity of light amendment, and the Rhine start. 276 is a counter for horizontal recording start positioning, is counted based on Q7 output (1 dot unit signal of videos) S83 from said sequence control counter 191, and outputs the horizontal recording start location (left margin) signal S84. 277 is a counter which determines a horizontal record termination location, and a count is performed based on the 8 dot unit signal S83 of said videos, and data write it, and it outputs the end location (right margin) signal S85. A count is performed based on the output of the gate 198 which considers Q output of the form tip location (page top) signal S74 which is a counter for perpendicular direction recording start positioning, and is outputted from input/output port 186, and a flip-flop 204 as two inputs, and 278 generates the page top count output S76. 279 is a counter for perpendicular direction record termination positioning, counts based on the output of the gate 198 like the above, and outputs the page end count signal S77. 280 is a counter for perpendicular direction test pattern control, counts based on Q output of said flip-flop 240, and outputs the test pattern control signal S79.

[0100] Drawing 26 is the detail circuit diagram of the interface circuitry 122 in drawing 13. In drawing 26, the 8-bit latch for a command and both the data of printing in the input/output port with which 263 sends out receipts, such as command data from the data control section 2 and a printing initiation command signal, the status data to the data control section 2, the ready state signal of a printing control section, etc., and 264, and 265 are the transceiver/receiver for interface data bus S59. The decoder for data selection-signal S60 as which 266 specifies the data on a data bus S59, and 269 show the control circuit of the BUSY signal which controls the data forwarding timing to command data and the data control section 2 at the time of printing data reception, respectively.

[0101] Next, the detail of an interface signal is explained. In drawing 26, with the data selection signal on a data bus S59, S59 chooses the 8-bit data bus of bidirection with the combination of two signals of IDCOM and IDSTA, and S60 chooses the data on said data bus S59. As for the signal with which the printing control section 100 tells in IPRDY that S61 is a ready state, the signal with which S62 permits sending out of the print start signal IPRNT from the data control section 2 by IPREQ, and S63, the data control section

2 side stops sending out of printing data by receiving this signal by IPEND. In IHSYN, S64 is the sending-out demand signal of printing data of one line, and S65 is a signal which a print initiation command signal and S30 permit an abbreviated name ISTB to by IBSY, and S66 permits the read by the side of sending-out authorization of said strobe signal S30, and the data control section 2 of status data with the strobe signal of a command and printing data by IPRNT.

[0102] A command and printing data are outputted to output Rhine S72 of a transceiver / receiver 265, when the status recognition signal S68 is OFF. The data on output Rhine S72 are latched to the data latch 264 by the strobe signal S30. And in the case of command data, after being latched to input/output port 263 and identifying the command, convention actuation which a command has is performed. Moreover, in the case of printing data, it is sent to said printing data write control circuit from an output line S59. Moreover, sending out of the data of the status is performed as follows. By receiving the request command of the status by the printing control-section 100 side, the contents of the status corresponding to the command are set to the status data output S71 of input/output port 263. The set status data S71 are inputted into a transceiver / receiver 265. The inputted data output that the status recognition signal S68 is ON on a data bus S59.

[0103] The detail of the command used by this printing control section 100 and the status is shown in drawing 27 and drawing 28, respectively. The status demand command corresponding to the statuses 1-6 in drawing 28 in SRs 1-6, the power save command to which PSON decreases the consumption power of a fixing assembly 331, and PSOF are the discharge commands of said power save condition, they decrease the consumption power of a fixing assembly 331 by the power save command PSON at the time of un-recording, aim at power saving, make power increase to the usual value with the power save discharge command PSOF at the time of record, and can carry out fixing of a toner in drawing 27. CSTU of the upper case feeding assignment command of a cassette and CSTL is the same, and the top / bottom margin assignment command with which a lower-berth assignment command, the command with which VSYNC directs sending-out initiation of printing data from the data control section 2, and MF 1-9 specify the assignment command in manual bypass mode, and TBM 1-4 specifies the printing starting position on a form, and SOF show the command which turns off shadow exposure compulsorily, respectively.

[0104] The printing control section 100 the status which shows that feeding of a form is performed and a form is conveying in a printer during paper conveyance in drawing 28, the status a select switch ON indicates it to be that the select switch 354 of a control unit was pushed, and a VSYNC request a print initiation command A receptacle, That reception of printing data was attained The status, and the top/bottom margin, as for the status to tell and manual bypass, feed mode indicates the condition of a selection cassette [ in / in the status and the cassette upper case / lower berth which tells that it is in a manual bypass condition / cassette feeding mode ] to be Said top / bottom margin command The status which shows the condition of the top/bottom margin chosen by (TBM 1-4), Cassette size (upper case) and cassette size (lower berth) the status and the data resending demand which show that the status . test / maintenance which shows the size code of the cassette with which it is equipped are in test/maintenance condition, respectively with a jam etc. Said power save command (PSON) shows that it is in the

condition of power save mode during the status which shows the case where re-printing is required, the status which shows that a printer is in the warm-up condition of a fixing assembly for the inside of weight, and power save. It is shown that the operator call factor of the status 4 has generated the operator call. It is shown that the serviceman call factor of the status 5 has generated the serviceman call. Tray full has a form more than regular number of sheets in a paper output tray, and it is shown that a tray is in a full condition. It is shown that toner back exchange is full of a toner in the toner back. It is shown that the form carried out the jam of the paper jam within the airframe. It is shown that the toner of those without a toner was lost in the toner hopper. It is shown that the door of a front has not closed covering opening. It is shown that the timing error had trouble in the printing data transfer. As for fixing assembly failure, a heater open circuit of a fixing assembly, a temperature FUSE piece, etc. show that abnormalities are in a fixing assembly. A laser diode does not reach a regular output or, as for laser failure, a beam detector shows that a beam is undetectable. Having separated from it from the specified speed by a certain cause, after scanning motor failure reached the regular rotational frequency, or it did not reach a specified speed, even if the scanning motor passed during starting Tokikazu scheduled time is shown. The fixing assembly roller counter of said drawing 15 reaches a regular value, and heating roller exchange shows that a fixing roller needs to be exchanged. As for drum exchange, a drum exchange counter reaches default value similarly, when a drum needs to be exchanged, a developer exchange counter reaches default value similarly, and developer exchange shows, respectively that it is a case to be exchanged [ of a developer ].

[0105] Drawing 29 is drawing showing the physical relationship of the beam detection location which enters in 1 time of the scanning zone of the laser beam containing the beam scan section 349 on the photo conductor 301 in drawing 3 and a scanning zone, the write-in location of data, etc. The beam which 416 is a beam scan start point, and 417 is a point ending [ beam scan ] in drawing 29 , and reached the point 417 ending [ beam scan ] starts the next beam scan from the beam scan start point 416 by time amount 0 according to the next field of the polygon mirror 313. 418 shows the beam detection start point of the beam detector 346, the left end side of a photoconductor drum and 429 are the same, and 428 shows a right end side, respectively. The form left end side of paper-size A3 and 420 are the same, and 419 expresses a right end side. The form left end side of paper-size A3 and 420 are the same, and 421 expresses a right end side. Similarly the data write-in start point of the form of A3 size with 421 [ same ] and 422 show the point ending [ data write-in ].

[0106] As for the form left end side of a paper size A6, and 424, 423 is the same, a right end side and 425 are the same, and the data write-in start point of the same size and 426 express the point ending [ data write-in ], respectively. Moreover, 427 expresses the central point of a form.

[0107] d4 expresses the distance to the point 426 of A6 size ending [ write-in ], the distance to an A3 size write-in start point and d5 are the more nearly same than the beam scan 418, the distance to an A6 size write-in start point and d6 are the same, and d7 expresses the distance to the point of A3 size ending [ write-in ], respectively. d8 expresses the distance to the form right end side 420 with A3 size from the point 418 detecting [ beam ]. Moreover, d3 expresses the range of the 1 scan of a beam. d14, d9, and d10 show A3 and the effective printing range in A6, respectively. After the printing

write-in start point from the beam detector location 418 changes with each paper sizes in order to always send centering on the form central point 427, therefore the beam detector 346 detects a beam according to paper size, the form feed of this printer \*\*\*\*s in the distance to each write-in start point, and needs to write in the data after time amount progress, so that clearly also from this Fig. While performing such control, since this printer has not adopted the lug delivery device of a form, it can be printed all over a form. In this example, although the left and the right margin of form right and left are set as 3mm, it is possible to set this to 0. Moreover, about the printer which performs the conventional lug delivery conveyance, an about 8-10mm margin is usually needed, and there is a fault of it becoming impossible to print the quite big part on a form.

[0108] Drawing 30 is not a horizontal chisel about the paper size and printing area part of drawing 29 , and expresses the whole form surface. In drawing 30 , 436A6 form and 437 express A3 form. About 419, 420, 421, 422, 423, and 424,425,426,427, the same location as drawing 29 is shown. In the tip of a form, and 432, the data write-in start point of a form perpendicular direction and 431 express the form back end of A3 size, and 433 expresses [ 430 ] the point of A3 size ending [ data write-in ]. 434 expresses the point of the form back end of A6 size, and 435A6 size ending [ data write-in ].

[0109] Next, an operation of said component is explained also with reference to the timing diagram of drawing 31 and drawing 32 .

[0110] The print (printing) of the ready signal IPRDYO of the printing control section 100 (S61) is attained. The print start signal IPREQO (S62) will be in an active state at coincidence. Next, the laser enable signal LDON1 (S49) starts to "1." The transistor 258 of drawing 17 is made to turn on with this signal S49. At this time, the flip-flops 226-228 for data of drawing 25 are not set, therefore both the printing data signal S47 and the shadow signal S48 have become "0." Since "1" and printing data are [ "0" and the shadow signal S48 ] "0" for laser enabling [ S49 ], the gate 246 of drawing 17 is materialized, and since an analog switch 254 is turned on, thereby, laser diode 259 emits light. Then, the photodiode 260 for monitors operates, an operational amplifier 239 operates through an operational amplifier 232, and the laser ready signal LRDY1 (S43) occurs. Next, synchronizing with Horizontal Synchronizing signal HSYO (S54), the sample signal SMP TO (S75) occurs from a counter 275. This signal S75 is used so that the time amount equivalent to the distance d3 (distance of one line) between 416-417 in drawing 29 which specifies a paper size may be set. Quantity of light amendment is used as \*\*\*\*\* and a Rhine start signal for every Rhine by this. That is, since the gate 193 of drawing 25 opens, the sample signal S45 occurs from the gate 194 and this sample signal S45 makes an analog switch 236 turn on through the gate 244 of drawing 17 with this signal S75, the signal for amendment will be given to laser diode 259, and quantity of light amendment for every Rhine is performed in this way. The output signal of the counter (page top counter) with which PTCTO (S76) has determined the tip of a form, and PECTO (S77) are the output signals of the counter (a page and counter) which has determined the termination location of a form. When it becomes the timing which can write in an image, the status of a VSYNC request is sent to an external device. If the VSYNC command comes out by this and it is received, PTO (S73) will come out and it is begun to count the number of Rhine of HSYNC from the point. It specifies to [ from the location ] how many it writes similarly (termination location). In order to enable it to change this assignment value, Top Margin nT and the HOTTOMU margin nE are formed. If the

above assignment is performed, when VSYNC comes, a PTOF signal will be outputted before the tip of a form. For example, if the 5mm margin is required, the number of Rhine including it will be counted. The top's [ being temporary ] value will set the data corresponding to 10mm, then the part of those to a timer. The location of a bottom is decided similarly. If data are set to a timer, it will count by opening the gate from there, and will start by count termination. Thus, it is the gate 201 of drawing 25 which is decided where [ where / from / to ] to write. LSTO (S78) is Q output of the flip-flop 204 for taking a synchronization, is set by HSYNC, and when a sample timer signal starts, it is reset. This reset line is contained in the LDON signal (S49) of drawing 25, and reset is compulsorily applied without usually committing a reset line. Q output of a flip-flop 204 occurs by reset, the clock generation circuit 190 works, and the clock from an oscillator 189 is counted. This clock generation circuit 190 carries out 4 dividing of the clock from an oscillator 189, and only while Rhine start signal latest starting time is set, it outputs the signal of bitwise. This output changes a phase and has become two kinds of signals S82 and S87. The synchronization for one line is taken by this. VDAT1 is a printing data signal (S47), and is outputted by actuation of the P/S conversion shift register 210 as serial data. That is, when a load signal is not impressed, the output S86 is "0", and although it operates with the signal S82 from the clock generation circuit 190, when (with no laser store) and the load signal S88 enter, the P/S conversion shift register 210 carries out serial conversion of the data D5-D12, and outputs them. At this time, it will be loaded to 8 bits by the gates 207-209 with 1 time of a period. The generating timing of a load signal is explained here. Although data will be set whenever a paper size changes when there is a location to actually write in, the counter which controls this is the left margin counter 276 (data are d9 and d10 of drawing 29) and the right margin counter 277 (data are dll [ of drawing 29 ], and d12) of drawing 25. The set in this case specifies the distance of the left and rye \*\* on the basis of the center of a form. If a latest-starting-time signal (S78) comes out synchronizing with an HSYNC signal, a flip-flop 196 is set, thereby, Gaea \*\* 198 will start \*\*\*\*\* and a counter 276 will start a count. The count in this case will count it by a unit of 1 time to 8 bits rather than will count a video clock for every bit. If the count output which comes out every 8 bits is set according to the left margin NLM and a right margin NRM, the count which synchronized with the latest-starting-time signal (S78) will be performed. And if it sets up and the number of counts is outputted, it will start. Therefore, the gate 201 has determined the lengthwise direction and it will write in the point when the gate 199 will have determined the longitudinal direction and both gate outputs are set to (1, 1). Said load signal is outputted to this timing, from a shift register 210, serial conversion of the data S86 is carried out, and they are sent out.

[0111] The Rhine memory out signal LMOT (S80) is the output of the OR gate 222. It controls whether this sends out which data of the Rhine memory 213 and 214. That is, this sending-out timing is controlled by the flip-flop 203. That is, since this flip-flop 203 will change an output state and will open the gates 220 and 221 by turns whenever a clock pulse is impressed, thereby, the Rhine memory 213 or the output DOUT of 214 is read by turns. Gaea \*\* 217.218 will also open the write-in timing to the Rhine memory 213,214 by turns, and it is controlled. Thus, when adopting the below-mentioned shadow method, it is for attaining carrying out smoothly of processing, as writing and read-out of data can be performed to coincidence.

[0112] Next, LDAON1 (S81) is explained also with reference to drawing 43 .

[0113] If it is in this kind of recording device, when \*\*\*\*\* laser is not usually emitted all over the shaft orientations of a photo conductor 301, it will print in many cases only in the forms (B5, A4, etc. like the form 458 shown in drawing 43 ) of small size, and a toner etc. will stop adhering to the part by the side of the both-ends nearness with which use is not presented for this reason. Moreover, even if it is the form (for example, form 461 of drawing 43 ) of big size, a free space exists (a use field is in the slash section 459 also about the form 458 of small size). Thus, in the phase which will fail to write an adhesion toner with the blade after record termination if the field where a long duration toner does not adhere is prepared, there is a problem that the contact resistance of the blade in a non-adhered part will attach a crack to a large next door photo conductor front face. Then, as shown in the timing diagram of drawing 31 , immediately after printing of one sheet of form finishes it as this equipment, the Rhine data-on signal LDAON1 (S81) is generated. Said fault is removed, as the printing data signal VDAT1 (S47) was compulsorily given within between this nascent state and Rhine (image) 460 and 463 covering the whole shaft-orientations surface of a photo conductor as shown in drawing 43 by this actuation was written after the printing termination of one sheet of form. In this case, when predetermined time tx has passed since the time of falling of data LDATn-1 before [ one ] the culmination data LDATn in the data of the Rhine memory out signal LMOT1 (S80), he is trying for the timing of the Rhine data writing to make it generate. in addition, such Rhine -- also \*\*\*\*\* (ing) -- after printing of each form is performed, you may set up so that it may write not only to what is written periodically but to every lot unit (every ten-sheet 100 sheets of every [ for example, ]).

[0114] Next, the method (it is also called a shadow method) currently used in order to make an alphabetic character etc. legible by \*\*\*\*\* which gives a "shadow" (shadow) to the alphabetic character printed also with reference to drawing 33 thru/or drawing 36 is explained in full detail.

[0115] Distinction of whether to generate the shadow signal S48 is performed by the various gates 220 which input the data of said Rhine memory 213,214 by turns thru/or 225, three flip-flops 226-228, and the gate 231 of the output side. Among those, a flip-flop 227 will contribute a flip-flop 228 to distinction of the shadow based on change of lateral (the direction of Rhine) level at distinction of the shadow based on change of the level of a lengthwise direction (perpendicular direction). That is, since the data of the front direction of Rhine are contained in the flip-flop 227 supposing the serial data which it is going to write in from now on is read from the Rhine memory 213 and this sets a flip-flop 226, when front data are in the condition of "1" in "0" for the present data, the shadow signal S48 is outputted, for example. The data of front Rhine are similarly compared with the data of present Rhine at the gate 223, for example, when data [ in / in the data of present Rhine / the same horizontal location of Rhine in front of "0" ] are "1", a flip-flop is set, and a shadow signal arises. In addition, also when both the flip-flops 227,228 are set, a shadow signal arises. This condition is shown as the shadow out signal SOUT1 (S86) of drawing 32 , the printing data signal VDAT1 (S47), and a shadow signal SDAT1 (S48).

[0116] Drawing 33 shows the conventional development pattern when not using said shadow method, and drawing 34 shows the development pattern at the time of using said shadow method. Thus, since a shadow (shadow) is given to drawing 32 when the

alphabetic character of "\*\*\*" is printed, it becomes very legible.

[0117] Drawing 36 makes a vertical line S1 and striping S2 intersect, and property Figs. R1 and R2 showing the relation between an exposure location and surface potential to property Fig. Q showing the surface potential of a photo conductor and the relation of exposure energy for property Figs. PAT1 and PAT2 showing an exposure location and the relation of exposure energy to an illustration upper right field to an illustration upper left field and an illustration lower left field are shown, respectively. This drawing extracts the direction "14-21" of Y in the direction of X "8" in the alphabetic character in drawing 33 and drawing 34. The properties PAT2 and R2 of the pattern shown in the properties PAT1 and R1 and drawing 34 of the pattern shown in drawing 33 as shown in this drawing are different things. If it is in a development property especially, in a certain development level L, it turns out that the width of face D2 of property Fig. R2 of drawing 34 is large rather than the width of face D1 of property Fig. R1 of drawing 36. In addition, drawing 35 is the property Fig. showing the relation between an exposure location and exposure energy, and the energy of time of laser radiation P (ON) is setting energy of 6mw(s) and shadow partial creation time P (SH) to 4mw(s).

[0118] It is as follows when the above shadow method is packed.

[0119] In what records recording information (text etc.) on a record photo conductor by beam scan corresponding to a beam difference on the strength While recording based on the beam (said P (ON) and P (OFF)) which has the 1st and the 2nd reinforcement, when said input data has a specific relation, input data binary [ serial ] It is what records by the beam of the 3rd reinforcement (halftone) which transposes to the beam of said 1st or 2nd reinforcement, and is located in the 1st or 2nd middle on the strength. Distinction of this specific relation For example, when a beam scan is what is performed one by one for every level Rhine, it distinguishes that the binary data in (a) level Rhine change from significant record data (data for forming an alphabetic character) to non-mind-record data (to data which are not contributed to alphabetic character formation). The data of current Rhine in scanning a part for the non-mind-record data division immediately after the change with the beam of the 3rd reinforcement and (b) level Rhine are compared with the data of the last Rhine of the perpendicularly are perpendicularly equivalent to the location. When changing from significant record data to non-mind-record data like the above (a), it is scanning the non-mind-record part immediately after change with the beam of the 3rd reinforcement.

[0120] In addition, the \*\* case which attaches said shadow, although you may adopt regardless of the class (for example, text and image information) of recording information, only when dealing with text, it is desirable to use this method. In this case, if it is text, it will shift to the flow of "Shadow" ON, and if it is things other than text (for example, image information), he is trying to make it it to be judged by the microprocessor for whether it is the flow of a "shadow", and carry out automatically, as shown in the flow chart of drawing 55, as a "shadow" is not operated. The command in this case is "SONF shadow ON/OFF" shown in drawing 27. Or a "shadow ON/OFF" switch is formed in a panel part, and an operator may enable it to choose it as arbitration.

[0121] If the above shadow methods are used, since a "shadow" can be attached when recording information is text, a quality of printed character can be raised. Since it can prevent "graze" especially and the printing concentration of 1-dot Rhine becomes high as a result, that quality of printed character can be raised also to kanji fonts of a high dot,



such as 40x 40-dot configuration. [ of Rhine by the printing concentration fall of 1 dot Rhine which was the fault of the recording method by the conventional binary beam reinforcement at the time of high density beam record ] Moreover, since the tolerance of the deflection of the perpendicular direction of the beam on the photo conductor by "face deflection" of a polygon mirror can be extended, it becomes easy to carry out processing of a polygon mirror, and there is also an advantage of becoming cheap.

[0122] In addition, it may be made to give said shadow also in the case of graphic form information simple besides text.

[0123] Next, electrification amendment is explained also with reference to the flow chart of drawing 37 thru/or drawing 41 , and drawing 59 .

[0124] The armature-voltage control circuit 445 where drawing 37 shows the example of 1 configuration in said high voltage power supply circuit 160 for electrification, and, as for this, motion control is performed by the high voltage power supply ON/OFF signal S35, The pressure-up transformer 446 which a frequency output is impressed to a primary side by this armature-voltage control circuit 445, and generates a high-pressure output from a secondary by it, The high-pressure rectifier circuit 447 which rectifies the output of the pressure-up transformer 446 and impresses a rectification output to said electrification charger 304, It is constituted by the current / electrical-potential-difference conversion circuit 450 which inputs the current which flows to the electrification charger 304, and changes it into an electrical potential difference, and the operational amplifier 449 which considers the output of this current / electrical-potential-difference conversion circuit 450 as one input, and considers the output of the control-standards electrical-potential-difference generating circuit 448 as the input of another side. Said control-standards electrical-potential-difference generating circuit 448 outputs a control-standards electrical potential difference which is controlled by the analog-control signal S36, and is different. While according to such a configuration the output frequency of the armature-voltage control circuit 445 is decided based on the output from the control-standards electrical-potential-difference generating circuit 448 and a high-pressure output occurs based on this, the current of the charger for electrification at this time is impressed to a current / electrical-potential-difference conversion circuit 450, an operational amplifier 449 compares this output voltage and reference voltage, and since control action is performed so that both may be in agreement, stabilization of output applied voltage can be attained.

[0125] Here, it explains to a detail per contents of the analog-control signal S36.

[0126] A photo conductor 301 has the property that surface potential changes with temperature changes sharply as shown in drawing 38 . In this drawing, temperature is shown on an axis of abscissa, surface potential variation  $\Delta V_O$  is shown on an axis of ordinate, and the property changes with classes 451,452,453 of drum, respectively. Moreover, drawing 39 shows the property Fig. showing the relation between drum inrush-current  $I_D$  of each drum 451,452,453 at the time of the temperature of 25 degrees C, and surface potential  $V_O$ , and serves as a proportionality straight line. Therefore, what is necessary is just to make the drum inrush current  $I_D$  change, in order to keep surface potential constant. For example, in order to maintain the surface potential of 800V about the drum of the property 451 in drawing 39 , it subtracts by inrush-current variation  $\Delta I_D$  corresponding to surface potential variation  $\Delta V_O$ , and about the drum of a property 453, it understands that only inrush-current variation  $\Delta I_D'$  equivalent to

surface potential  $\Delta V_0$  should make it increase (the various property data of said photo conductor are contained in said RAM107). Since it has a correspondence relation as it is indicated in drawing 40 as an inrush current ID and the output current here, the above-mentioned inrush current ID can be adjusted by changing the analog signal (input voltage) S36 to the control-standards electrical-potential-difference generating circuit 44 in said high voltage power supply circuit 160 for electrification with 2V, 4V, and 6V. Drawing 41 is analog input current (what is necessary is to show the relation between the output voltage of D/A converter 165 of drawing 15, and temperature, and to detect the temperature of a drum 301 with said temperature sensor 342 (thermistor of drawing 14), for example, just to impress said analog-control signal S36 corresponding to a temperature change).

[0127] Although more than solves and said electrification amendment is performed based on the contents, the actuation is explained based on drawing 56. If the thermistor 342 shown in drawing 14 detects the temperature of a drum, A/D converter 271 will change into a digital signal, and if data conversion is completed, the value  $D\Delta T$  which subtracted the temperature data  $DT_{25}$  of the drum at the time of being the temperature data  $DT_n$  and the temperature of 25 degrees C will be read. Next, the temperature o'clock [ the o'clock of 25 degrees C ] criteria data  $DV_{25}$  are read,  $DV_{25} + D\Delta V$  is calculated, and the calculation result  $DV_n$  is outputted to D/A converter 165. And with reference to RAM107, the drum property NO is identified for the drum property data of the address "6000" shown in drawing 45, and feedback error data  $D\Delta V$  is read further. Next, the temperature o'clock [ the o'clock of 25 degrees C ] criteria data  $DV_{25}$  are read,  $DV_{25} + D\Delta V$  is calculated, and the result of an operation  $DV_n$  is outputted to D/A converter 165. and the analog input of the high voltage power supply 160 for electrification --  $V_n$  -- impressing (S36) -- it amends by changing the control input signal S35 of the high voltage power supply 160 for electrification into ON condition. Whenever temperature changes, the above-mentioned amendment is repeated and he is trying to keep the surface potential of a drum constant.

[0128] In addition, the operator enables it to specify from the outside about the property of the various photo conductors (drum) memorized by nonvolatile RAM 107. That is, after turning ON a test key by setting the drum property NO if it is drum exchange when distinction of being drum exchange is performed as shown in the flow Fig. (a rounded envelope C shows.) of drawing 63, the writing of the drum property NO is performed in the drum property NO area of nonvolatile RAM 107. Therefore, after that, the property of the drum always used now is chosen and amendment is performed based on this.

[0129] Since the electrification potential of a photo conductor will be kept constant even if the temperature of a photo conductor changes with the temperature rises in external-environment change and a gas if the above electrification amendments are performed, generating of faults, such as a fogging by the fall of electrification potential based on a temperature change, the fall of printing concentration, or electrification potential rise, can be prevented, and always clear printing can be offered. Moreover, since amendment according to it is performed by inputting information which classified the temperature characteristic of a photo conductor according to this example (external setup), temperature compensation of an electrification property can be performed in a very high precision. Therefore, the variation in the temperature characteristic of the photo conductor itself can also be eased, and there is also an advantage that the range of the

specification of a photo conductor can be extended.

[0130] Next, actuation of this whole equipment is explained also with reference to the timing diagram of the flow chart of drawing 47 thru/or drawing 59 and drawing 60 thru/or drawing 62 .

[0131] After a power source ON, it is checked [ that OFF and the temperature fuze 130 do not serve as / the door switch 129 / OFF and the delivery switch 336 / OFF and the manual stop switch 328 / OFF and the pass sensor 123 / \*\* and ] whether a paper output tray 384 is full (FULL), and test print mode, maintenance mode, and exchange mode is checked further. If each is satisfactory, the MC relay 131 will be turned on, ON and the scanning motor 312 serve as [ the fixing assembly heater lamp 333 ] ON, and Timer A (TIMA) starts. If Timer ATIMA counts predetermined time t1, the device sections, such as a drum motor and a development counter motor, will serve as ON, and laser 344 will be turned on if TIMA next counts predetermined time t2. If time amount t25 counts by TIMA, it will be distinguished whether you are a laser ready, if it is yes (Y), next TIMA=t26 will be clocked, an imprint charger, laser, a development counter motor, and development sleeve bias will serve as OFF, respectively, and a drum motor, a heating roller motor, an electric discharge lamp, and the electric discharge lamp before an imprint will serve as OFF further at the time of time amount progress of TIMA=t27. Next, it is judged to the timing of TIMA=t29 whether you are a scanning motor ready and an HSYNC ready, and TIMA will be stopped if it is yes (Y) (above drawing 47 ).

[0132] Next, distinction of "the tray full in the status 4" is performed, and distinction of "toner back exchange" and distinction of being "with no toner" are performed. If it is "tray full", the flag of "tray full" will be set to "0" after the form removal in a paper output tray, a paper output tray counter is reset, if it is "toner back exchange", reset will be performed in the phase in which the condition returned to origin, and reset is performed in the phase which returned also when it was TONA 1 supply. If the above flow is passed, it will be distinguished next whether it is "in [ power save ]" in "the status 3". [ \*\*\*\*\* ] No, if it is (N), distinction of "having no paper" in "the status 4" will be performed next. Yes, if it is (Y), it will be distinguished whether it is "the cassette-paperless detection ON", if it is a no (N), a "with [ no paper ]" flag will be set to "0", and if it is a "fixing assembly ready", it will be made the flag "in stay TASUU \*\* Ito" "0." Next, IPRDY If it is set to ON and IPREQON, and it is distinguished [ whether it is "under / power save /" \*\*\*\*\* , and ], respectively whether it is "with no paper" and it is satisfactory, TIMA will start. The resist motor 149 is reversed by TIMA=t01, and a resist motor stops by TIMA=t02. The tip of paper is pinched by the feed roller in this phase. next, whether it is "manual bypass" distinguishes -- having -- no, if it is (N), whether it is "IPRNT ON" will distinguish -- having -- yes, if it is (Y), "IPREQ OFF" will come. Next, it will be distinguished whether Timer E (TIME) is working, if working, "TIME=t30" will be distinguished, if it is yes (Y), it will become a TIME stop and the imprint charger 305, the exfoliation (exfoliation) charger 306, the development counter motor 141, and the fixing assembly motor 143 will be turned on, respectively. If it is not "TIME=t30", TIME will be stopped and will shift to the flow of a rounded envelope F (above drawing 48 ).

[0133] next, TIMA -- starting -- the blade solenoid 158 -- ON -- becoming -- "TIMA=t1" -- the development counter motor 141, the electric discharge lamp 302, the front [ imprint ] electric discharge lamp 303, and the drum motor 147 -- each serves as ON. The imprint

charger 305 and the fixing assembly motor 143 serve as ON by "TIMA=t2."

[0134] The exfoliation charger 306 serves as ON by "TIMA=t3", and then TIMA is again started from "0" at the time of "TIMA=t4." Next, a cassette upper case and the lower berth are distinguished [ whether it is "manual bypass" and ], if it is an upper case, the feed motor 151 will be rotated normally, upper case feeding will be performed, if it is the lower berth, after waiting to "TIMA=t5", the feed motor 151 is reversed and lower-berth feeding is performed. Next, laser 344 is made to turn on at the time of "TIMA=t5", and the electrification charger 304 is made to turn on at the time of "TIMA=t6." It confirms whether to be a laser ready by "TIMA=t7", and if it is yes (Y), the "VSYNC request" flag in "the status 1" will be set to "1." Timer B (TIMB) is started after that and it shifts to the flow of a rounded envelope G (above [drawing 49](#) ).

[0135] next, "TIMA=t31" -- the feed motor 151 -- stopping -- "a VSYNC command receipt" -- distinguishing -- yes -- if it is (Y) -- "TIMB<t32" \*\*\*\*\* -- distinguishing -- yes, if it is (Y), TIMB will be made to stop and it will consider as count initiation of "the page top", and "a page and a counter", and image write-in processing. Timers C and D (TIMC, D) are started and a TIMA stop and feed motor 151 halt are carried out by "TIMA=t34." Next, it is referred to as resist motor 149 normal rotation and \*-

TARUKAUNTA 354ON by "TIMC/D=t35", and the height of toner concentration is distinguished by "TIMC/D=t36." When concentration is low, the toner supply motor 159 is turned ON. "Next they are a page and an interrupt" is distinguished, and if it is yes (Y), an image write-in termination IPEND pulse will be made to output. Each counter is set to +1 after that, and each condition will be displayed if it is "\*\*\* lei full", "drum exchange", "developer exchange", and "heating roller exchange." OFF in addition, the distinction result of the above "a VSYNC command receipt" -- no -- if it is (N) -- "TIMB=t46" -- the electrification charger 304 -- By "TIMB=t47", laser 344, exfoliation charger 304OFF, Laser 344, the exfoliation charger 306, and the development counter motor 141 are turned off by "TIMB=t47", respectively. The imprint charger 305 and the fixing assembly motor 143 are turned off by "TIMB=t48", respectively. It sets to OFF by "TIMB=t49", and the blade solenoid 158 is set to OFF for the drum motor 147, the electric discharge lamp 302, and the electric discharge lamp 303 before an imprint by "TIMB=t50", respectively. Moreover, by the flow of the above "TIMB<t32", if it is a no (N), "TIMB<t33" will be distinguished next, and if it is a no (N), it will consider as a TIMB stop and a TIMA start. The blade solenoid 158 is turned ON after that, and the development counter motor 141, the drum motor 147, the electric discharge lamp 302, and the electric discharge lamp 303 before an imprint are set to ON in the phase of "TIMA=t1", respectively. And the imprint charger 305 and the fixing assembly motor 143 are set to ON at the time of "TIMA=t2", and the exfoliation charger 306 is set to ON at the time of "TIMA=t3." Next, it distinguishes that it is "TIMA=t4", and Timer A is made to once stop and is started again. And the development counter motor 141, the imprint charger 305, the exfoliation charger 306, and the fixing assembly motor 143 are made to turn on, respectively. By "TIMA=t5", electrification charger 304ON is performed by laser 344ON and "TIMA=t6", and it distinguishes that he is a laser ready by "TIMA=t7", and TIMA will be made to stop if it is yes (Y) (above [drawing 50](#) ).

[0136] Next, it distinguishes whether it is "toner full pilot-switch 126" ON, and in a display, if it is ON, if it is not ON, it will be distinguished whether it is "toner-less pilot-switch 125" ON, and a display will be performed. Next, distinction of being "manual

bypass 1" is performed, if it is not manual bypass, distinction of "having no assignment cassette paper" will be performed next, and if there is no paper, STPF (stop flag) will be carried out to a display to that effect "1." Next, Timer E (TIME) is started. If a stop flag is "1", STPF will be set to "0" and the print ready IPRDY will be turned OFF. When it is not STPF=1, distinction of being "manual bypass 1" is performed, if it is "manual bypass 1", a TIME stop, manual stop switch 328OFF, manual bypass "O", TIMB stop, and distinction of being the cassette-paper-less detection switch ON will be performed, and then, it is a print request IPREQ. It is turned on and shifts to the flow of the rounded envelope I of said drawing 48 (above drawing 51 ).

[0137] Next, the contents of the timer interruption in said each flow are explained with reference to drawing 52 and drawing 53 . It distinguishes whether as for this, each timers A, B, C, D, and E are working respectively, and when each is working, it counts up. All input is read by part for a port input read station. And the timer is made to stop by "TIMC/D=t38", it distinguishes whether it is "TIME=t39", actuation of Timer E (TIME) is continued henceforth, and "the toner supply motor 159" and the "resist motor 149" are stopped for every time amount. the degree -- after "TIME=t4" -- -- it distinguishes whether it is TIMA working" (this is for judging whether the print of the following form is performed). TIME will be made to stop if TIMA is working. Laser 344, the exfoliation charger 306, and the development counter motor 141 are set to OFF by electrification charger 304OFF and "TIME=t42] by "TIME=t41" after that, respectively. It turns OFF by "TIME=t43" and the drum motor 147, the electric discharge lamp 302, and the electric discharge lamp 303 before an imprint are turned OFF for the imprint charger 305 and the fixing assembly motor 143 by "TIME=t44", respectively (above drawing 52 ). Distinction of blade solenoid 158OFF, a TIME stop, distinction of "fixing assembly temperature normal" no, whether "whether it to be a fixing assembly temperature fuze stage", whether "whether you to be scanning motor 312 ready", and whether "whether to be door-switch 129OFF" is performed by "TIME=t45", and various processings are performed according to each condition.

[0138] Next, the contents of the command interrupt in said each flow are explained with reference to drawing 54 . If processing of command interruption is started, it is distinguished whether it is a "parity error", and if it is an error, the flag of "the status DATA 81" will be set to "1", and will serve as "an illegal command error." If it is not a "parity error", it will be judged for a "stator request" whether it is the range of SRs 1-6, and when it is within the limits, the output corresponding to either of them occurs. It is judged whether they are "the top/bottom margin", if it corresponds to neither of a "status request", if that is right, "the top/bottom margin" will be specified, it will be set to "1" by the "status set", and either of "DATAs 21-11" will be specified. When it is not "the top/bottom margin", it is judged whether it is "manual bypass assignment", if it is yes (Y), next a manual bypass display and a paper size display will be performed, and a paper size register will be set. And it shifts to the flow from which it becomes the status 1 by the manual bypass status set, the "DATA41" flag is set to "1", and then a paper-less flag is set to "0" as the status 4. When it is not "manual bypass assignment", it is judged whether it is "cassette assignment", if it is "cassette assignment", a top / lower-berth display paper size display will be performed, a paper size register is set, and it becomes manual bypass status reset, and becomes the status 1, it is judged whether he has DTA41 flag "0" and any cassette paper, and it will become a flag "1" if you have no paper. If it is

yes (Y), it will become Select light lighting, when it is not "cassette assignment", it will be judged whether it is "Select light lighting", it will be judged whether it is on-line Select light (what is specified from external device, for example, host, side) lighting, when it is not selection RAMBU lighting, it is judged whether it is Select light putting out lights, and if it is yes, it will become Select light putting out lights, and, in the case of a no (N), will shift to the following flow.

[0139] Next, the flow chart shown in drawing 55 thru/or drawing 58 is explained.

[0140] "Power save" is contained in drawing 55 in addition to the above-mentioned "shadow method." If it is [ power ] "under save", scanning motor 312OFF and a fixing assembly will be controlled to power save temperature. It considers as "the power save flag 1 of the status 3", and supposes control and "it is a flag 0 during status 3 power save" to scanning motor 312ON and fixing assembly usual temperature at the time of power save discharge, and if it is "image data transfer initiation", it will shift to the flow of drawing 56 , drawing 57 , and drawing 58 .

[0141] reading of a paper size register is performed, reading of the Top Margin table data (D1) of assignment paper size is performed, and the top / bottom margin assignment distinguishes whether it is 5mm -- having -- no, read of the top / bottom margin modification table data D2 is performed by (N). Next, the operation of the Top Margin table data D1+ margin modification table data D2 is performed, and the contents of the Top Margin adjustment switch (442 of drawing 14 ) are read. Next, reading of the Top Margin adjustment table data D3 corresponding to a switch is performed, addition and subtraction of the margin adjustment table data D3 are carried out to the value of D1 and (D1+D2), and the result of an operation D4 is set to the page top counter 278. And the bottom margin table data D5 of assignment paper size are read, it is distinguished for the top / bottom margin assignment whether it is 5mm, if it is a no (N), read of the top / bottom margin modification table data D2 will be performed, subtraction with the bottom margin table data D5 and the margin modification table data D2 is performed, the contents of the Top Margin adjustment switch 442 are read, and the Top Margin adjustment table data D3 corresponding to a switch are read. D5 [ next, ] -- the margin adjustment table data D3 are subtracted and added to a value, and or (D5-D2) sets the result of an operation D4 to a page counter 279. Next, reading of the right margin table data D7 of assignment paper size is performed, and distinction of a cassette/manual bypass is performed. If it is cassette selection, distinction of being an upper case (criteria) will be performed, if it is not an upper case, it will become the lower berth, and the contents of a cassette upper case / the lower-berth adjustment switch (440 of drawing 14 ) are read, and the cassette top / lower-berth adjustment table data D8 corresponding to a switch are read. Said D8 is subtracted and added to said value of D7, and the calculation result D9 or said D7 is set to the right margin counter 277. Moreover, the contents of a cassette / the manual bypass adjustment switch (441 of drawing 14 ) are read, the cassette / manual bypass adjustment table data D10 corresponding to a switch are read, then, the adjustment table data D10 are subtracted and added to said value of D7, and when manual bypass is specified, the calculation result D11 is set to the right margin counter 277.

[0142] Next, reading of the left margin table data D12 of assignment paper size is performed, distinction of a cassette/manual bypass is performed, if it is a cassette, distinction of being an upper case (criteria) will be performed, if it is not an upper case, it

will be judged as the lower berth, and the contents of a cassette top / the lower-berth adjustment switch 440 are read, and the cassette top / lower-berth adjustment table data D8 corresponding to a switch are read. Said data D8 are subtracted and added to said value of D12, and the calculation result D13 or said data D12 is set to the left margin counter 276. Moreover, if it is manual bypass, the contents of a cassette / the manual bypass adjustment switch 441 will be read, the cassette / manual bypass adjustment table data D10 corresponding to a switch will be read, addition and subtraction with the value of the data D10 and said data D12 will be performed, and the calculation result D14 will be set to the left margin counter 276.

[0143] The detail of the above-mentioned cassette form printing in a flow is shown in the timing diagram of drawing 60 . If print start signal IPRNTphi (S65) comes out, print initiation enabling-signal IPREQphi (S62) will start. Development counter motor 141 grade is turned on after that, the feed motor 151 operates between time of day t4-t8, and the form in a cassette is conveyed. At this time, a laser diode 344 serves as ON at time of day t5, and the writing of data is started from time of day t7 (the period of the slash of time of day t7-t11 is a data write-in period). The resist motor 149 rotates at time of day t9, and the write-in data to a photo conductor are imprinted by the form. The writing of data is performed till the time of day t11 when IPREQphi (S62) falls, and the resist motor 149 continues rotating and stops till the after [ time-of-day t11 progress ] time of day t12. Laser diode 344 serves as OFF at time of day t14 after that.

[0144] Drawing 61 and drawing 62 are the timing diagrams for explanation of manual bypass form printing of operation. The following explanation explains a different part from the case of the above-mentioned cassette form printing.

[0145] Inverse rotation of the resist motor 149 is carried out without using the feed motor 151, and a feed roller is driven, and he uses for form conveyance and is trying to drive a resist roller by forward rotation in drawing 61 and drawing 62 . Moreover, after a "manual bypass command" comes in both, he is trying for print initiation command IPREQphi (S62) to start. A resist motor carries out inverse rotation again at the time of day when it stopped at where the resist motor 149 will carry out inverse rotation a little after time of day t01 after that if the case where a form is set to a manual-bypass guide before a "manual-bypass command" generates drawing 61 is shown and the manual feed switch 326 is turned on with a form set, and the tip of a form is added, and the "manual-bypass command" came out at, and IPREQphi (S62) started, a form conveys to an imprint location, and it stops. Therefore, if it is before taking out a "manual bypass command", printing to the form from a cassette is also possible. The direction of drawing 59 is the case where the form was set to the manual bypass guide and the manual field switch 326 is turned on, after a "manual bypass command" comes out previously, and it carries out inverse rotation of the resist motor 149 continuously after predetermined time t01 progress in this case, and he is trying to convey it to an imprint location. In addition, although he is trying for the resist motor 149 to be suspended at the time of day t21 after predetermined period progress after the manual stop switch 328 turns off in any case (time of day t20), a "jam" will be generated even if longer than the size as which the form set to the manual bypass guide by this is displayed. Since size is specified in the case of the cassette form, such consideration is unnecessary. Therefore, it also becomes possible to use the form of the size which can print if the form of size bigger even when a cassette form is exhausted than the size of the information which should be printed is prepared,

and is not in specification, and the availability of equipment increases.

[0146] The contents of the flow of rounded envelopes A, B, and C which shifts from the flow of said drawing 47 are explained with reference to drawing 63.

[0147] If test print mode is chosen, it will shift to FU opening - of a rounded envelope A, and activation of the print specified by the printing mode NO through the test key is performed. If maintenance mode is chosen, will shift to the flow of a rounded envelope B, and actuation in the maintenance mode of NO specified through the test key is performed. If exchange mode is chosen, it will shift to the flow of a rounded envelope C. "Is it drum exchange?" It is distinguished "whether it is developer exchange" and whether "whether it be heating roller exchange", and processing of predetermined data to the non-volatilized student RAM 107 is performed by a "drum property NO set", a "developer exchange NO set", and a "heating roller NO set" through a test key, respectively.

[0148] Drawing 64 thru/or drawing 66 are the correspondence Figs. which matched Display NO and each contents.

[0149]

[Effect of the Invention] According to invention according to claim 1, the laser control unit which can control semiconductor laser by the condition of having been stabilized, very with high precision can be offered.

[0150] According to invention according to claim 2, the laser control unit which can ensure stabilization of an optical output in actuation of a switching means can be offered.

[0151] According to invention according to claim 3, the laser control unit which can perform minute control of the optical output of semiconductor laser can be offered.

[0152] According to invention according to claim 4, the laser control unit with which responsibility can control semiconductor laser by the good condition can be offered, preventing power loss.

#### TECHNICAL FIELD

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[Industrial Application] This invention relates to the laser control unit which stabilizes the optical output of semiconductor laser.

#### PRIOR ART

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[Description of the Prior Art] Although semiconductor laser has been applied in various fields in recent years, it has been important conditions to stabilize laser intensity in every field. In case the optical output of semiconductor laser is switched to a multistage story and used especially properly, stabilization of the optical output at the time of this switch is an important problem. Furthermore, since temperature dependence of semiconductor laser is large, an optical output changes sharply also by few temperature changes, and stabilization of an optical output is much more difficult for it.

[0003] By the way, semiconductor laser has the property which is very much easy to damage to abnormal current and abnormal voltage. Conventionally, on the occasion of stabilization of laser intensity, abnormal current flowed to semiconductor laser, or abnormal voltage might be impressed, and the rate of breakage of semiconductor laser was large. Moreover, the transistor for a modulation is conventionally used for the modulation of semiconductor laser. Usually, modulation frequency of this transistor for a modulation is performed by about 4-10MHz, and quick responsibility is required. Therefore, the transistor for a modulation is for RFs and is adopted. However, power loss



arose in relation with a junction capacitance, and the transistor for high frequency had the problem that the transistor of a high current had to be arranged so that it may compensate this power loss.

#### EFFECT OF THE INVENTION

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[Effect of the Invention] According to invention according to claim 1, the laser control unit which can control semiconductor laser by the condition of having been stabilized, very with high precision can be offered.

[0150] According to invention according to claim 2, the laser control unit which can ensure stabilization of an optical output in actuation of a switching means can be offered.

[0151] According to invention according to claim 3, the laser control unit which can perform minute control of the optical output of semiconductor laser can be offered.

[0152] According to invention according to claim 4, the laser control unit with which responsibility can control semiconductor laser by the good condition can be offered, preventing power loss.

#### TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] While accomplishing this invention in view of the above-mentioned situation and aiming at improvement in precision in stabilization of the optical output of semiconductor laser, the failure rate of semiconductor laser can be reduced sharply, without abnormal current etc. flowing on the occasion of stabilization, and power loss is reduced, responsibility is good and control of a minute optical output is also aimed at offering a possible laser control unit.

#### MEANS

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[Means for Solving the Problem] A laser control means according to claim 1 has a comparison means compare with the output voltage and the reference voltage of said current-electrical-potential-difference conversion means a photodetection means detect the output of semiconductor laser, and a current-electrical-potential-difference conversion means change the output current of said photodetection means into an electrical potential difference, an integral means perform charge and discharge according to the output of said comparison means, and a voltage-current conversion means transform into a current the electrical potential difference charged by said integral means, and supply semiconductor laser.

[0006] Said integral means has a switching means, when performing quantity of light stabilization actuation of said semiconductor laser, it makes said switching means ON condition, and a laser control device according to claim 2 makes said switching means an OFF condition, when performing modulation actuation of said laser.

[0007] A laser control unit according to claim 3 performs a quantity of light setup of said semiconductor laser by carrying out adjustable [ of said reference voltage ].

[0008] A laser control unit according to claim 4 makes said current driving means always drive, in case said voltage-current conversion means has the current driving means which passes the current below the threshold current from which semiconductor laser starts an optical oscillation to said semiconductor laser and modulates said semiconductor laser.

#### OPERATION

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[Function] According to that comparison result after a photodetection means' detecting the optical output of semiconductor laser according to the laser control unit according to claim 1, changing the output current of this photodetection means into an electrical potential difference with a current-electrical-potential-difference conversion means and comparing with the reference voltage of a comparison means, an integral means performs charge and discharge, the charge electrical potential difference of an integral means is further transformed into a current with a voltage-current conversion means, and it is made to supply semiconductor laser.

[0010] Therefore, it will be controlled so that the optical output of semiconductor laser becomes fixed, and stabilization of an optical output with a very high precision can be attained irrespective of temperature fluctuation. Since especially the comparison means has the cis- TERISHISU property, its stabilization of a comparative judgment improves and it can be contributed to the improvement in precision of stabilization of an optical output.

[0011] Moreover, since a current is gradually raised by quite late time amount by work of an integral means when semiconductor laser is turned on, abnormal current does not flow to semiconductor laser and the failure rate of semiconductor laser is reduced sharply.

[0012] Furthermore, since the optical output of optical output setting reference voltage and semiconductor laser is in proportionality, an exact optical output setup can be performed.

[0013] Since according to the laser control device according to claim 2 the switching means formed in the integral means is set to ON in the case of quantity of light stabilization actuation of semiconductor laser and is made into an OFF state in the case of modulation actuation, stabilization of the optical output of semiconductor laser can be ensured.

[0014] Since a quantity of light setup of semiconductor laser is performed by carrying out adjustable [ of the reference voltage ] according to the laser control unit according to claim 3, a minute optical output is controllable by changing reference voltage.

[0015] According to the laser control unit according to claim 4, in case semiconductor laser is modulated, since the current below the threshold current which causes an optical oscillation is supplied to semiconductor laser by actuation of a current driving means, responsibility can control semiconductor laser by the good condition, without being accompanied by power loss using the current driving means of small power.

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## EXAMPLE

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[Example] It explains referring to one example of the illustration which applied this invention hereafter.

[0017] Drawing 1 is the block diagram of the system for recording information on a record medium by the laser beam. The information on the host side systems 1 (a computer, body of a word processor, etc.) which deliver information is given to the data control section 2. In the data control section 2, the information given from the host side system 1 is changed into the data of dot correspondence, and it memorizes in page memory.

[0018] The data of this memorized dot image are sent out to the printing control section 100.

[0019] In the printing control section 100, by modulating a laser beam for the inputted dot image data, it writes in on a record medium, the development imprint of it is carried out, and said dot image data is printed on a record form.

[0020] Drawing 2 shows the device detail drawing with a video interface of a printer 300, and a printer 300 contains the printing control section 100 of drawing 2.

[0021] In drawing 2, the photo conductor as image support for 300 to record the body of a printer by the laser beam, and for 301 record information and 302 consist of two or more red LED with the electric discharge lamp for discharging the charge of said photo conductor 301 to an initial state. 303 is an electric discharge lamp for gathering imprint effectiveness, and consists of two or more red LED like said electric discharge lamp 302. An imprint charger for an electrification charger for 304 to electrify said photo conductor 301 in predetermined potential uniformly and 305 to make a form imprinting the toner developed on said photo conductor 301 and 306 are the exfoliation chargers for making the form after an imprint separate from said photo conductor.

[0022] A development counter for 307 to make the electrostatic latent image written in by the laser beam on said photo conductor 301 developing and 308 are the components of said development counter 307, are a magnet roller for making said toner adhere to the electrostatic latent image on said photo conductor 301, and rotate in the direction of an arrow head.

[0023] The auto toner probe for 309 contacting the developer of said magnet roller and measuring the toner ratio concentration of a developer and 310 are the cleaning blades for removing the toner which remains on said photo conductor 301 after an imprint.

[0024] A scanning motor for the polygon mirror of eight face pieces for a laser-scanner unit for 311 to scan a laser beam, become irregular and record the video data inputted from the data control section on said photo conductor 301, and 312 to draw the laser beam from a laser diode on said photo conductor 301 and 313 to rotate said polygon mirror 312 at high speed and 314 are the f-theta lenses for making regularity the scan speed of the laser beam on said photo conductor 301. 315 and 316 are the reflective mirrors for leading the laser beam from said scanner unit 311 to said photo conductor 301.

[0025] An upper case feeding roller for the upper case side cassette by which 317 can contain 500 sheets of forms, and 318 to pick out one sheet of form at a time from said upper case cassette 317, the upper-case-paper-less switch which detects that the form of 319 was exhausted to said upper case cassette 317, and 320 are upper case cassette size pilot switches which have been prepared in said upper case cassette 317 and which consisted of 4 bits which detects the mark for size discernment. In 321, a lower-berth feeding roller and 323 show a lower-berth-paper-less switch, and 324 shows a lower-berth cassette size pilot switch, respectively. Moreover, it has usable structure also in the cassette which can contain a lower-berth side 250 sheets in an upper case side.

[0026] The feed roller for manual bypass for the manual feed switch which detects the form with which 326 was inserted from the manual bypass guide 325, and 327 to convey the form, after insertion is checked by said manual feed switch 326, and 328 are manual stop switches which detect the form conveyed with said manual paper feed roller 327.

[0027] A resist roller for 329 to make it take the synchronization with the image and form which were developed on said photo conductor 301, and 330 with said exfoliation charger 306 The separated form to a fixing assembly A thermistor for a heater lamp for a

fixing assembly for the conveyance belt for conveying and 331 to fix the toner on the imprinted form and 332 to heat the roller for fixing, and for 333 heat said fixing roller and 334 to detect the skin temperature of said fixing roller and 335 A delivery roller, 336 is a delivery switch for detecting the form discharged from said fixing assembly 331.

[0028] A cooling fan for 337 to cool the inside of a printer 300, the high-pressure transformer which 338 makes generate the high-pressure electrical potential difference impressed to said electrification charger 304, the imprint charger 305, the exfoliation charger 306 and said development counter, and a magnet roller 308, respectively, the power unit which generates DC electrical potential difference on which 339 is used for each control, and 340 are PC board units which control a printer 300.

[0029] 342 is a drum temperature sensor for detecting the temperature of a photo conductor 301 established near the photo conductor 301, and the very small thermistor of thermal resistance is used.

[0030] Drawing 3 is the perspective view showing the outline of the part for performing information record to said photo conductor 301 by the laser beam. In drawing 3, the laser beam which came out from semiconductor laser 344 is amended by the collimator lens 343 at parallel light, and is applied to the 1st page in which eight face pieces of the polygon mirror 313 have the parallel light. The laser beam which carried out incidence of it to said polygon mirror since the polygon mirror 313 was carrying out high-speed rotation in the direction of an arrow head by the scanning motor 312 lets the f-theta lens 314 pass, and the range of the beam scanning zone 348 is scanned rightward from the left. Some laser beams in the beam scanning zone 348 are led to the beam detector 346 by the reflective mirror 345. Therefore, said beam detector 346 detects the laser beam scanned for every one horizontal scanning by the 1st page of said polygon mirror 313. Moreover, the laser beam by which incidence is not carried out to the reflective mirror 345 in the beam scanning zone 348 is irradiated by said photo conductor 301. The place where the laser beam on the photo conductor 301 in drawing 3 is scanned is shown in 349. 304 shows an electrification charger and 347 shows a form, respectively. In addition, as shown in drawing 2, when the laser beam which passed the f-theta lens 314 is not irradiated by the direct photo conductor 301 but an actual printer is reflected by the reflective mirrors 315 and 316, \*\*\*\*\* does not illustrate the reflective mirrors 315 and 316 for convenience in drawing 3 to a photo conductor 301. The laser beam which passed the f-theta lens 314 is shown so that the direct photo conductor 301 may irradiate.

[0031] Here, the configuration of said reflective mirror 345 is explained with reference to drawing 42. As shown in this drawing, it is attached on the screw 455 through the flat spring 454 on the supporter material 456 located outside a beam incidence field, the fine-tuning screw 457 is formed in the lower part of this flat spring 454, and this reflective mirror 345 can change now the include angle of the reflective mirror 345.

[0032] The laser-scanner unit shown in drawing 3 and drawing 42 is intercepted from the outside so that clearly also from the place shown in drawing 2, and he is trying for a scanning beam not to leak. And the detection result of the beam detection by the beam detector 346 is displayed in the proper location of the scan panel shown in drawing 6.

[0033] Drawing 4 is the explanatory view of the pass-before resist roller sensor 394. The purpose of the pass-before resist roller sensor 394 detects the form at the time of cassette feeding to the manual stop switch 328 in drawing 2 performing only detection of a manual bypass form. In drawing 4, paper is fed to the form to which paper was fed from

the upper case cassette 317 and the lower-berth cassette 321 by one of the upper case feeding roller 318 and the lower-berth feeding rollers 322 even to the resist roller 329 along with a form guide plate. At this time, the light which came out from the light emitting diode 393 when feeding was performed correctly can check the form to which paper was fed when it was intercepted with a form and light did not go into said pass-before resist roller sensor 394. Moreover, since a form does not reach to the location of said pass-before resist roller sensor and incidence of the light from said light emitting diode 393 is continuing being carried out to said pass-before resist roller sensor when feeding is not able to carry out correctly, it can recognize that paper was not fed to the form.

[0034] Drawing 5 is the schematic diagram of the reversal tray 381 which is an option unit. Usually, the tray 397 of a noninverting form is attached in the appearance shown in the printer 300 at drawing 2 . When such a noninverting form is used, since it turns down, since data must be sent out from the last page, the first print form has the fault to which the file approach of the information on a host system 1 becomes complicated from information delivery equipment (host system 1). Therefore, in order to compensate said fault, this reversal tray 381 is indispensable.

[0035] The form which passed the delivery roller 335 of a printer 300 in drawing 5 is contained with the reversed mold with the time of passing said delivery roller 335 on a tray 384 with the conveyance roller 382,383. Therefore, although the first page is the bottom since the printing side of a form has turned down, from a tray 384, if drawing and the printing side of a form are made into a side front, the first page can turn up, the last page will turn them down, and the fault of the above-mentioned noninverting form tray 397 can solve a form. In addition, 385 is a form stopper and can be made to slide in this drawing according to the conveyance lay length of a print form. Light emitting diode for a delivery switch for a form presser-foot actuator for 388 to prevent the relief of the form contained by the tray and 395 to check that the form has been normally contained by the tray 384 and 391 to check the existence of the form in a tray 384 and 392 are the tray sensors by the side of light-receiving. When a form 390 is in a tray 384, light does not shine upon the tray sensor 392, but when there is no form 390, and light shines upon the tray sensor 392, the existence of a form 390 can be detected.

[0036] The other examples of form existence and a formful of a detecting element are shown in drawing 44 . while this forms an actuator 388 focusing on the rotation supporting point 386 -- the upper part -- a lever 398 -- forming successively -- the tip of a lever 398 -- isolation -- a means -- a solenoid 389 and discharge -- a means -- it energizes in the any 1 direction with the coil 387, and he moves a lever 398 according to the condition that paper is contained by the paper stowage 390, and is trying to detect the condition at this time with the detection means 401,402, for example, two or more sensors In the various conditions of an actuator 388, "those with paper" and the location of a3 will be [ the location of a1 / "paper is full" and the location of a2 ] in the condition of "having no paper." printing when said isolation means 389 should isolate an actuator 388 while discharge migration of the form 390 is carried out into a paper output tray 384 at least, and a form should be detected -- working or during a halt, a solenoid 389 becomes off synchronizing with the condition signal at that time, the elongation of an actuator 388 is canceled, and detection actuation is performed. For this reason, trouble does not arise in discharge actuation, without the discharge tip of a form 390 colliding

with an actuator 388.

[0037] In addition, the form sent in a paper output tray is detected by the delivery switch 395 for every sheet, it counts with the delivery memory counter (RAM107 of drawing 3) which these contents mention later, and number of sheets is detected. And if it becomes "full [ paper ]", while being displayed on the tray full lamp 358 of drawing 6, said memory counter is cleared.

[0038] Drawing 6 is the detail drawing of the control panel of a printer 300.

[0039] In drawing 6, in 350, top covering of a printer 300 and 351 become a front cover, 352 has become maintenance covering, and when a paper jam, toner supply, etc. arise, said front cover 351 is opened in the direction of an arrow head, and processes.

Moreover, although said maintenance covering 352 has structure opened in the upper part, it has structure which cannot be opened unless it is in the condition which opened said front cover 351 in the direction of an arrow head, and prevents an operator's operation mistake.

[0040] 353 is the mechanical counter of 6 figures and is carried out plus 1 for every printing to one sheet of form. The select switch with which 354 selects online/off-line, and 355 correspond to said select switch 354. The Select light turned on at the time of online, and 356 by the seven segment LED of a single figure The contents of an error at the time of a serviceman call, The mode number at the time of maintenance mode etc. The numerical indicator to display, the line indicator which indicates that, as for 357, the power source is supplied to the printer 300, the tray full lamp which tells that 358 is full of a print form to said reversal form tray unit 381, and 359 the detail of the operating state of a printer The color LCD drop to display is shown, respectively. The total counter 353 thru/or the LCD drop 359 explained until now is always operated or displayed. Next, the part which cannot be operated unless it opens said maintenance covering 352 is explained. Only a serviceman operates the following parts.

[0041] The maintenance switch for selection of maintenance mode and exchange mode in 403, the display lamp in which it is shown that 406 is in a maintenance mode condition, the display lamp in which it is shown that 407 is in an exchange mode condition, and 404 selection of the mode of operation NO at the time of each mode The selecting switch to perform, the thing \*\*\*\* selection lamp which 408 can selection operate by said selecting switch 404, and 405 Selection and the above-mentioned maintenance in test print mode, The test switch for performing exchange and actuation in each mode condition of a test print, the volume for the Maine exposure adjustment which 360 mentions later, and 361 show the volume for shadow exposure adjustment, respectively. Moreover, by hand, said not both volumes of 360,361 can be turned, where it has the structure where the driver for adjustment is inserted and turned and said maintenance covering 352 is opened.

[0042] Drawing 7 is the detail drawing of said LCD drop 359, and explains the function of each display segment below.

[0043] 371,372 is a segment which shows standby of a printer 300, a ready state, etc., and 371,372 switches off only 371 by the 371,372 concurrent LGT and the ready state at the time of lighting and print actuation at the time of the standby to a fixing assembly ready.

[0044] 373 blinks at the time of jam generating of the feed section, and the segment which shows the feed condition also blinks it to coincidence. Namely, the lower-berth cassette 363 blinks at the time of the upper case cassette 364 and a lower-berth cassette at the time of the manual bypass assignment 365 and upper case cassette mode at the time

of manual bypass mode. In the case of a conveyance system (resist roller 329 or subsequent ones) jam, 374 blinks. A feed segment as well as [ at this time ] a feed jam blinks to coincidence. The toner collected by the cleaning blade 310 of drawing 2 blinks 375, when the toner back (not shown) is full. 376 blinks, when a toner is lost in the toner hopper (not shown) of a development counter 307. 377,378 blinks, when the serviceman error mentioned later occurs. 379 blinks, when the operator call mentioned later occurs. 380 blinks, when there is no form in the cassette chosen. 362 displays the size of the paper chosen. For example, the upper case cassette side is chosen, if it is the form cassette of A4 length, A4-R will light up, and if A6 is chosen in manual bypass mode, A6 will light up. When, as for 363, the lower-berth side cassette is chosen and, as for lighting and 364, the upper case side cassette is chosen, lighting and 365 are turned on when manual bypass is chosen. 366 expresses the configuration of a printer 300, lighting and 367 always express a photo conductor 301, lighting and 368 always express the up configuration of a printer 300, and lighting and 369 always turn on said 368 by turns at the time of a conveyance section jam (at the time [ Said 374 ] of flashing) except the time of a conveyance section jam. 370 is five segments which display the conveyance condition of a form, and while one segment lights up from right-hand side to left-hand side, it moves.

[0045] Drawing 8 is the outline block diagram of the data control section 2 in said drawing 1. The character code information and image information which have been sent out from the host side system 1 are made to memorize after data conversion in the data control section 2 on the page memory 20 corresponding to a dot corresponding to the printing area on the form of a printer 300. Moreover, the data on the memorized page memory 20 are sent out to a printer 300, and printing actuation is made to perform.

[0046] It consists of the data control sections 2 so that two kinds of information may be received. That is, it is character code information (JIS eight-level code etc.), and in this case, with a character generator 15, one generates the character pattern corresponding to that character code, and it memorizes the dot information on a character pattern on the page memory 20. Another side is image information, and in this case, since it is already inputted in the form of dot information, it memorizes on the page memory 20 as it is. Henceforth, the outline of the data control section 2 is explained with reference to drawing 8.

[0047] The information on the host side system 1 is sent to an interface 50 through a signal line SO 1, and said information is further memorized by the data latch 3.

[0048] The signal line SO 2 of an interface 50 and a host system 1 is sent out from the host side system 1. The signal line SO 3 for control of the strobe signal of data and others is the busy signal and status signal line from a data control unit.

[0049] A format of the information sent from the host side system 1 is shown in drawing 9 and drawing 10. The alphabetic character identification code which shows that the example of a format of drawing 9 is the format in the case of character code information, and is character code information, and the paper size code which shows the size of the form to print are contained in the beginning for 1 page. Character code data are contained henceforth in order of the 1st line and -- of 2nd line the n-th line, and the END code which finally shows the end of data of the page is contained. Moreover, the character code data for one line consist of the code which shows a character size, the character code, and the LF code showing the delimiter of data of one line.

[0050] Drawing 10 is the format in the case of image information, and the image identification code which shows image information, and the paper size identification code which shows the size of the form to print are contained in the beginning of the data for 1 page. Henceforth, image data is contained in order of one line and two lines -- m lines. Moreover, since it is specified with said paper size discernment data, data of one line are automatically distinguished by counting by the data specified in the data control section 2 side.

[0051] The input from a distributor 4 is processed as follows. The information which always went into the distributor 4 with the output line SO 4 is inputted into the decoder 5 from the distributor 4. First, if the case of character code information is described, and the alphabetic character identification code of drawing 9 is inputted into a decoder 5, the output of a decoder 5 will be inputted into the main control section 6 through a signal line SO 5. In the main control section 6, it distinguishes that the information inputted is character code information, and the following paper size data are inputted into the page code buffer control circuit 7 to a distributor 4 with a signal line SO 6, and an appearance command is carried out. Therefore, paper size data are inputted into a page code buffer control circuit through data-line SO7 from a distributor 4. Next, the continuing data to the 1st line and -- of 2nd line the n-th line are inputted into a page code buffer through data-line SO8 from a distributor 4. Character code data are memorized by the memory area on the page code buffer 9 specified by the address counter 8 at this time. If the input of the character code information for 1 page is completed to a page code buffer and the END code of drawing 9 is detected by the decoder 5, the END code detection will be told to the main control section 6 and the page code buffer control circuit 7 with signal lines SO5 and SO9, respectively. The page buffer control circuit's 7 check of that the character code input for 1 page to a page code buffer was completed with the signal line SO 9 performs the data storage in the dot unit to the page memory 20.

[0052] Correspondence with the room on the page memory 20 and a form is shown in drawing 11 . In drawing 11 , a broken line shows the outside of each form. 25 [ namely, ] -- the tip (each size community) of a form, and 24 -- the left end (each size community) of a form, and 28 -- in the right end of A3 size form, and 31, the back end of A5 size form and 30 show the back end of A4 size form, and, as for the right end of A5 size form, and 27, 29 shows [ the right end of A4 size form, and 26 ] the back end of A3 size form, respectively. 32 shows the point of the address ADR of the address counter 19 for read-out, and the address counter 18 for writing (0 0). Both ADR (0 0) expresses that the perpendicular direction address (ADRV) and the horizontal address (ADRH) are "0" here. That is, the address counter 18 for writing and the address counter 19 for read-out are realized from the perpendicular direction address (ADRV) and the horizontal address (ADRH), as shown in drawing 12 , ADRV expresses the perpendicular direction address ( drawing 11 arrow head b), and ADRH expresses the horizontal address ( drawing 11 arrow head c).

[0053] As for the level address (A3 HE) of the last of A3 size form, and 44, 43 is [ the level address (A4 HE) of A4 size form and 45 ] the level addresses (A5 HE) of A5 size form. Similarly, in 46, the perpendicular address (A3VE) of the last of A3 size form and 47 express the perpendicular address (A4VE) of A4 size, and 48 expresses the perpendicular address (A5VE) of A5 size. As for 33, perpendicular address ADRV=0 of A3 size, the point ADR of level address ADRH=A3 HE (O, A3 HE), and 34 show ADR



(O, A5 HE) similarly, respectively, as for ADR (O, A4 HE) and 35. Moreover, as for 36, the point ADR (A3 VE and O) of perpendicular address  $ADRV = (A3VE)$  of A3 size and level address  $ADRH = O$  and 37 show ADR (A5VE, 0) similarly, respectively, as for ADR (A4 VE and O) and 38. 39 -- the point ADR of perpendicular address  $ADRV = A3VE$  of A3 size, and level address  $ADRH = A3 HE$  (A3VE, A3 HE) -- similarly, 40 shows ADR (A4VE, A4 HE) and 41 shows ADR (A5VE, A5 HE), respectively. Storage in the dot image of the character pattern to the page memory 20 with the above rooms is performed as follows. Character-size data of the 1st line are read through a signal line S10 in the page code buffer control circuit 7 from the page code buffer 9. 40x40 and two sorts of fonts of 32x32 dots have been to the base, and the class of character size in this example distinguishes a character size in read character-size code, and sends [ in the page code buffer control circuit 7 ] the distinction signal to the page memory control circuit 17 through a signal line S13 to a character generator 15 through a signal line S11, respectively. In the page memory control circuit 17, control of a paragraph pitch and a character pitch is performed, and character-size area is switched with a character generator 15 with said character-size distinction signal, respectively.

[0054] The character code after character-size data is transmitted to the area specified as the line buffer 10 with the memory space for one line with the line address counter 11. After the transfer to the line buffer 10 of the character code data for one line is completed, the line address counter 11 returns to the initial address (0). First, the writing to the page memory 20 of Rhine ( drawing 11 , Rhine, 57) of the 1st character-font perpendicular direction is performed. Here, Rhine / scanning counter 13 is set to initial value (0 0), and the value of the address counter 18 for a store serves as ADR (0 0). The character code data of the line buffer 10 are latched to the output latch 12 in order in order to perform read-out in the cycle of sequential regularity and to take the synchronization with a line counter 13 from a top digit. If a top character code (this example "T" alphabetic character) is latched to the output latch 12, the output of the character code, and the Rhine / scanning counter 13 will be compounded in the synthetic circuit 14, and it will be inputted into a character generator 15 as a character-pattern select code of a character generator 15. Here, if the configuration of Rhine / scanning counter 13 is explained, 6 bits of high orders have become the counter, i.e., the counter of the lengthwise direction of a character pattern, which counts a scan line, zero to 39 \*\*\*\*\* , in the case of the alphabetic character of 40x40 dots, it will count by the paragraph pitch control line, and it will return to "0." The low order triplet serves as a counter of the longitudinal direction of a character pattern, in the case of the font of 40x40 dots, it counts by 0-4 plus character-pitch control, and it returns to "0" (the output of a character generator 15 is because 8 bits is parallel).

[0055] Hereafter, the actuation in for spacing of 8 bits of the lengthwise direction of a part for spacing of 8 bits of the longitudinal direction of a font size 40x40 and an alphabetic character and an alphabetic character is explained. If a top character code ("T") is set to the output latch 12 as mentioned above, the output of the character code, and the Rhine / scanning counter 13 will be compounded in the synthetic circuit 14, and it will be inputted into a character generator 15 as a character-pattern select code of a character generator 15. At this time, since the value of Rhine / scanning counter is (0, 0), the data (8 bits) of eye lengthwise direction "0" Rhine eye and longitudinal direction "0" watch of that character pattern are outputted to the output of a character generator 15. The

output data of a character generator 15 are written in the address on the page memory 20 which was once latched to the output latch 16 and was specified as him by the page memory control circuit 17 with the address counter 18 for a store, in order [ to the page memory 20 ] to take the synchronization of writing. In this case, since the value of the address counter 18 for a store serves as ADR (0 0), it is written in the address of the perpendicular address "0" and level address "0." And after the store of 1 byte of character pattern is completed, the value of Rhine / scanning counter changes to (0, 1), and the value of the address counter 18 for a store also changes to ADR (0 1). Therefore, after the data of eye lengthwise direction "0" Rhine eye and longitudinal direction "1" watch of a character pattern are outputted to the output of a character generator 15 and being latched to the output latch 16 like the above-mentioned, it is written in the ADR (0 1) address of the page memory 20. Thus, after the writing of the data of the last (data of the "4th" watch) of the lengthwise direction "0" Rhine eye of one character pattern is completed, in the value of Rhine / scanning counter, (0, 5), and the address counter 18 for a store serve as ADR (0 5). Since spacing of the longitudinal direction of an alphabetic character is 8 dots (1 byte), the output of a character generator 15 is compulsorily set to "0" altogether by the command from the page code buffer control circuit 7, "0" is written in the ADR (0 5) address of the page memory 20, after write-in actuation termination, a line address counter is added "1" and the following character code is set to the output latch 12 from the line buffer 10. Moreover, (0, 0), and the address counter 18 for a store are set to ADR (0 6) by Rhine / scanning counter. Therefore, as for a degree, write-in actuation to the page memory 20 of the data of the character-pattern lengthwise direction "0" Rhine eye of "0" is performed. At this time, the address counter 18 for a store carries out sequential count-up with ADR (0 6), (0, 7), (0, 8), (0, 9), and (0, A), and writes the character-pattern data of O in the address specified with the address counter 18 for a store, respectively. And if the value of (0, B) Rhine / scanning counter 13 is set to (0, 5) by the value of the address counter 18 for a store, "0" is written in the page memory 20 like the above-mentioned, after write-in actuation termination, a line address counter will be added "1" and the following character code will be set to the output latch 12 from the line buffer 10. [0056] Moreover, (0, 0), and the address counter 18 for a store are set to ADR (0 C) by Rhine / scanning counter 13. Thus, the writing to the page memory 20 of the character-pattern data of a lengthwise direction "0" Rhine eye is performed one by one, and if the "LF" code is outputted to the output of the line buffer 10, the "LF" code detecting signal will be told to the page code buffer control circuit 7 through an output line S14, and write-in actuation of the character pattern from a character generator 15 will stop. And after it, sequential plus "1" is carried out and the address counter 18 for a store writes "0" in the page memory 20 compulsorily. And if present A3 size is specified and the value of the address counter 18 for a store will become 33 points of the value, i.e., drawing 11, of ADR (0 A3 HE), 18(0) Rhine / ADR (1 0), line address counter 11, and scan counter 13 will be set to (1, 0) for the address counter 18 for a store after said compulsive "0" write-in actuation, respectively. And "T" which is a top character code is again set to the output latch 12 from the line buffer 10. And the character-pattern data of the lengthwise direction "1" Rhine eye of a character pattern are written in \*-JIMEMORI 20. The lengthwise direction "2", "3" which are a character pattern similarly -- Termination of the write-in actuation to "39" Rhine eye sets [ the address counter 18 for a store ] (0) Rhine / scanning counter 13 to (28, 0) for ADR (28 0) and the line address counter 11,

respectively. Although write-in actuation of the character-pattern data for one line is termination above, since a paragraph pitch is next every 48 lines, it remains, and "0" is compulsorily written in the page memory 20 by eight lines. And after the writing of "0" for eight lines is completed, the line address counter 11 is set to the point (30 0), i.e., ADR, of 61 of drawing 11, and (0) Rhine / scanning counter is set to initial value (0 0) for the address value of the address counter 18 for a store, respectively. All write-in actuation that also contained the paragraph pitch for one line now is completed. And the character code data of the 2nd line as follows are transmitted to the line buffer 10 from the page code buffer 9. After a character code data transfer is completed, the line address counter 11 returns to the initial address (0). Then, the writing of character-pattern data of the 2nd line is performed in the same actuation as the writing of character-pattern data of the 1st line. Therefore, completion of all of write-in actuation of the 2nd line of character-pattern data sets [ the address value of the address counter for a store ] (0) Rhine / scanning counter to (0, 0) for ADR (60 0) and the line address counter 11, respectively. Thus, one by one, the character code of each line is patternized, and pattern data are written in on the page memory 20, and it dies. And if the "END" code which shows a last line is detected from a line buffer, data write-in actuation of said character pattern will stop. And while setting the output of a character generator 15 to "0" compulsorily through a signal line S13 from the page code buffer control circuit 7, write-in termination of character-pattern data is told to the page memory control circuit 17. In the page memory control circuit 17, if said write-in terminate signal is received, "0" will be compulsorily written in to the remaining memory areas in the page memory 20 by which paper size assignment was carried out henceforth to the last memory address (in the case of A3 size Fig. 1139 -point ADR (A3VE, A3 HE)). And writing and all the write-in actuation to the page memory 20 of the character-pattern data for one-page assignment paper size complete "0" to 39 points of drawing 11. And (0) Rhine / scanning counter 13 is altogether initialized [ the address counter 18 for a store ] for ADR (0 0) and the line address counter 11 by (0, 0).

[0057] Next, the case where the data sent from the host side system 1 are image information is described. If the image identification code of drawing 10 is inputted into a decoder 5, the output of a decoder 5 will be inputted into the main control section 6 through a signal line S05. In the main control section 6, it distinguishes that the information inputted is image information, and the following paper size data are inputted into the page memory control circuit 17 to a distributor 4 with a signal line S06, and an appearance command is carried out. Therefore, paper size data are inputted into the page memory control circuit 17 through the data line S07 from a distributor 4. Next, the continuing image data 1 and 2 and the image data to --m are inputted into the page memory 20 through the data line S15 from a distributor 4. The image entry-of-data approach to the page memory 20 is performed as follows. A page memory control circuit sets the address counter 18 for a store to ADR (0 0) so that it may write in the image data following a degree from 32 points (address ADR (0 0)) of drawing 11, if said paper size identification code is received. And the data length for the horizontal direction of one line is decided by referring to the table in the page memory control circuit 17 from paper size identification code. Therefore, supposing the paper size of the image information to be inputted into the page memory 20 from now on is A4, the data length of one line will become the value HE to 44 points (A4 HE) of drawing 11, i.e., "A4." Since the die

length of the image information per [ which is sent from the host side system 1 ] line naturally also serves as "A4 HE", a data length is "A4VE" and, as for several m image data, the image data 1 of Fig. 10, image data 2, and -- image data m have become the value of 47 points of drawing 11 , i.e., "A4VE." Therefore, for 32-point ADR (0 0) - 34-point ADR (0 A4 HE) of drawing 11 , and image data 2, to the page memory 20, Rhine and the image data 3 of 51 points are [ the image data 1 of drawing 10 ] Rhine of 52 points. -- In Rhine, therefore the last address of 37 points, image data m serves as ADR (A4VE, A4 HE) 40 point. Thus, image information is written in the page memory 20, controlling the address counter 18 for a store.

[0058] Thus, the character-pattern data 13 written in the page memory 20 send out the data which print the data of the address shown in the address counter 19 for read-out to a printing control section through an interface bus S17 through the sequential output latch 21, a gate circuit 23, and an interface 22. The command data line with which S17 performs the status data line from a printing control section to a printing control section, and S18 performs assignment of a mode of operation etc. in drawing 8 , and S19 and S20 command data and the strobe signal line at the time of printing data forwarding, and S21 The page and signal line with which the Horizontal Synchronizing signal line from a printing control section and S23 are the same, and the busy signal line from a printing control section and S22 tell termination of printing data, and S24 The ready signal line of a printing control section, the print request signal line which tells the condition which S25 can print, the selection signal line with which S26 specifies the contents of data of the data line in said interface bus S17 (two lines), S27 is a printing start signal line which orders it initiation of printing actuation to a printing control section.

[0059] If it explains in more detail about the time of the data forwarding to a printing control section, in printing [ section / 2 / data control ], a printing control section will send Horizontal Synchronizing signal S22 to the start signal line S27. With this Horizontal Synchronizing signal S22, first Rhine of 32 points of drawing 11 , The address counter 19 for read-out also changes the address of one line at a time one by one according to said Horizontal Synchronizing signal S22., therefore it carries out sequential sending out of each data of Rhine of 51 points with following Horizontal Synchronizing signal S22 If the data of the area where this actuation was repeated and the page memory 20 was specified are sent out to a printing control section and a page and a signal S23 are received, sending out of data will be compulsorily stopped, until it receives the page and signal S23 from a printing control section. The timing which takes out a page and a signal S23 with a printing control section is taken out with the same timing as said Horizontal Synchronizing signal S22. Moreover, at correspondence with the memory address of drawing 11 , by last Rhine A3 of the memory area of the paper size, 46 point, in A4, it is the same as 47 points, or is outputted from a printing control section to the timing before it.

[0060] Moreover, the value of the address counter 19 for read-out and the address counter 18 for a store is always compared, and if sending out of the printing data from the page memory 20 is started, if the value of the address counter 19 for read-out is larger, it will be controlled by the page memory control circuit 17 to permit write-in actuation to the memory area which sending out of the data ended. Therefore, the loss of the write time to the page memory 20 decreases very much.

[0061] Drawing 13 shows the block diagram of the printing control section 100 in

drawing 1 . In drawing 13 , a microprocessor for 101 to control each unit in the printing control section 100 and 102 are the interrupt control circuits for controlling the interrupt to a microprocessor 101, and tell the interruption-request signal from each of the page from the command signal line S30 from an interface circuitry 122, and the printing data write control circuit 19 and a signal line S29, and the time-out signal line S28 from the general-purpose timer 103 to a microprocessor 101. 103 is a general-purpose timer and generates basic timing signals for control, such as paper conveyance and a circumference process of a drum. This general-purpose timer 103 is set as 10msec(s) by this example. 104 is ROM (read-only memory) and all the programs for control for operating the printing control section 100 are contained. The data table which 105 is similarly ROM and is different in said ROM104 is contained. The contents of the data table are shown in drawing 45 . In drawing 45 , the data for right margin control are contained in the address (4000 4001) at the data for the Top Margin control in the case of paper size A3, and the address (4002 4003) in the data for left margin control, and the address (4006 4007) in the data for bottom margin control, and the address (4004 4005), respectively. The top in the case of paper size B4, a bottom, the left, and each data for margin control of a light are contained in the address (4008-400F) similarly. The data for margin control corresponding to various kinds of paper sizes are contained to the address (4087) below. And these data for margin control are used as set data of the counter for margin control in the printing data write control circuit 119 mentioned later.

[0062] Up to the address (4100 - 41FF), the table of the command code for assignment [ section / 2 / data control ] of operation is contained, and it is used for the command code check from the data control section 2. The contents of the command are the top / bottom margin modification table, the Top Margin adjustment table, a cassette top / preparations ready table, a cassette / manual bypass adjustment table, etc. Up to the address (4200 - 42FF), the data of the electrification property of a photoconductor drum 301 are contained, and five kinds of data of A-F are contained. And this data is used for temperature compensation control of the charger 304 for electrification mentioned later. Up to the address (4300 - 43FF), it is an exchange data table and each exchange cycle data of the developer in a photoconductor drum 301 and a development counter 307 and a fixing roller 332 is contained.

[0063] Up to the address (4400 - 47FF), the various timer values for being a timer table for control and performing printing actuation, such as each process timing and feed timing, are contained.

[0064] 106 is RAM (random access memory), it is the memory for working, and in it, as shown in drawing 46 , the contents of Timers (TIM) A, B, --, E, a paper size register (the cassette size data based on the signal of the cassette size pilot switch 320,324 mentioned later are memorized), the statuses 1-6, and others are contained. Said microprocessor 101 compares the cassette size memorized by the paper size register with the size of the recording information (image data etc.) from the external device sent from said data control section 2, and if the cassette size is larger, it will take out a printing operating command to the latter printing control section 100. Therefore, it can print, even if larger than the information size to which a print form is sent from the outside, and improvement in an availability can be aimed at. As for 107, it is held by the non-volatilized student RAM also at the time of power-source cutoff, as for the data in memory. Moreover, the contents of data in said non-volatilized student RAM are shown in drawing 45 . In

drawing 45 , the drum property NO of having been inputted by exchange mode from the control unit is contained, the jam information at the time of jam generating is contained in the address (6100), and the address (6000) is used for prevention of a processing failure of jam paper inside the plane when a power source is once turned off at the time of a jam. The address (6200) is the paper output tray counter which counts the form in the reversal tray 381, and whenever one sheet of form is sent to the reversal tray 381, it is counted up every [ 1 ]. It is displayed on a control unit that this counted value will be in a tray full condition to reach to default value, and a form is picked out from a tray to an operator. Moreover, this paper output tray counter will be automatically cleared, if a form is picked out from a tray by the operator. Therefore, even if a power source is turned off, the number of the forms which remain in the tray is held by this counter.

[0065] The address (6300) is a drum exchange counter and is counted up every [ per printing / 1 ]. When the value of this counter reaches the value of the exchange table (drum) of said drawing 45 , an operator is told about exchange of a drum by the display of a control unit.

[0066] The address (6400) is a developer exchange counter, is counted up every [ 1 ] for every printing like said drum exchange, and when the value of this counter reaches the value of the exchange table (developer) of said drawing 45 , it is displayed on a control unit.

[0067] The address (6500) is a fixing roller exchange counter, and it counts up every [ 1 ] for every printing like said drum exchange, and it is displayed on a control unit that the value of the exchange table (fixing roller) of drawing 45 is reached.

[0068] 108 is a power sequencing circuit and has the work which prevents the operation mistake at the time of the power source ON of said non-volatilized student RAM 107, or a power source OFF. 399 is a power unit which supplies the power source to a control section. 110 is input/output port and reads the output of the indicative data to the actuation display 111, each actuation switch data, etc. 112 is input port which reads the input data from each detector 113 in the printing control section 100. 116 shows driver elements, such as a motor, a high voltage power supply lamp, a solenoid, a fan, and a heater. 115 is the drive circuit of said driver element 116, and 114 is an output port which gives the output signal to said drive circuit 115. A laser scanning motor for 312 to operate a laser beam and 118 are the drive circuit, and 117 is input/output port which gives the drive control signal to said drive circuit.

[0069] The laser modulation circuit as a laser control unit which performs control whose 120 344 contains semiconductor laser and contains the light modulation of said semiconductor laser, and 346 are beam detectors which detect the light beam currently operated by said laser scanning motor, and the PIN diode which carries out a high-speed response is used. The high-speed comparator for 121 digitizing the analog signal from said beam detector, and making a horizontal synchronizing pulse and 119 are printing data write control circuits which perform control which writes the printing data of the video image transmitted from the data control section 2 in the position on a photo conductor 301, generating of test pattern printing data, etc. 122 is an interface circuitry which controls the receipt of the command data from the output of the status data to the data control section 2, and the data control section 2, and printing data etc.

[0070] Hereafter, the detail of the main blocks in drawing 13 is explained. Drawing 14 is the detail circuit diagram of the various detectors 113 in drawing 13 . In drawing 14 , the

signal from various kinds of detectors is inputted into a multiplexer 139. In a multiplexer, it is inputted into the input port 112 of drawing 13 by the 8-bit signal S32 with a select signal S31.

[0071] 320 is an upper case cassette size pilot switch, consists of four switches and expresses paper size with those combination. 324 is a lower-berth cassette size pilot switch, and the configuration is the same as that of said upper case cassette size pilot switch. 319 is a cassette-upper-case-paper-less switch, and a switch will be turned on if paper is exhausted to a cassette. 323 is the paper-less switch of the lower berth. 123 is a pass-before resist roller sensor, and the cds photo detector is used. Bias voltage is impressed through resistance (not shown) and, as for this sensor, output voltage changes with the existence of a form. Therefore, the signal which distinguishes the existence of a form is acquired by inputting into the comparator 124 with which the output is impressed to reference voltage Vref1.

[0072] The manual feed switch whose 326 detects the form from the manual bypass guide 325, the delivery switch which 336 has in the fixing roller section, and the delivery switch which 395 has in the paper output tray section are shown. The toner-less pilot switch to which 125 detects those without a toner in a toner box, and 126 show the toner back the toner full pilot switch which operates when a toner fills, respectively.

[0073] 127 is the detection sensor (probe concentration detection sensor) of the toner ratio concentration of a developer, and the photodiode is used. Bias voltage is impressed through resistance and, as for this sensor, output voltage changes with the concentration of a toner. Therefore, by inputting the output into a comparator 128, impression, now since it is, the signal of 1 or 0 is acquired [ reference voltage Vref2 ] for toner concentration by the input terminal of another side of a comparator 128 above default value or by the following, respectively.

[0074] The door switch which carries out ON/OFF of 129 by closing motion of a front cover, the temperature fuze by which 130 is prepared in the fixing assembly, and 131 are MC relays to which ON/OFF of the power source for a drive (+24VB) is carried out. Since one side of said temperature fuze 130 is connected to power-source +24VA, when the temperature fuze 130 melts by the abnormalities of a fixing assembly, said MC relay 131 is turned off and the power source for a drive is turned off. Moreover, the temperature fuze 130 is connected to resistance RO1, and one side of resistance RO1 is connected to the input of resistance RO2 and a comparator 132. Moreover, reference voltage Vref3 is impressed to other inputs of a comparator 132. Therefore, if the temperature fuze 130 melts, the input of a comparator 132 will be set to OV. Therefore, the fusing detecting signal of a temperature fuze is outputted to the output of a comparator 132. 133 is a destination change-over switch, by ON/OFF of this switch, ON condition serves as country turning inward (A and B size), and, specifically, OFF serves as \*\*\*\*\* (legal one, letter size). Even when it follows, for example, the combination of the code by the cassette size switch (four pieces) of said upper case or the lower berth is the same, according to the condition of this switch, the paper size of country turning inward / U.S. \*\*\*\*\* is chosen.

[0075] 134 is a jam reset switch and is installed in the front cover. This switch is a switch switch on in the sense of a check after an operator exchanges jam processing or a toner bag, when a paper jam or an operator tonerful of a call arises. Therefore, unless it turns on this switch after said processing, a jam or a control unit tonerful of a display is not

cleared. 392 is a paper output tray sensor which detects the form in the tray in drawing 5 . 334 is the thermistor which detects the temperature of a fixing assembly, the detection temperature of this thermistor becomes fixed and appearance control of it is carried out. The output of a thermistor 334 is connected to the input side of resistance RO3 and a comparator 136,137. Therefore, the input voltage of a comparator changes in connection with the change in resistance by the temperature of a thermistor 334. That is, if temperature becomes high, the input voltage will become high. The electrical potential difference by which the partial pressure was carried out is impressed to the input terminal of another side of a comparator 136 by resistance RO6 and RO7, and the output of a comparator 136 changes to it by whether it is higher than this reference voltage by which the partial pressure was carried out, or low. Moreover, resistance RO8 is connected at the node of resistance RO6 and RO7, and one of these is connected to the collector of a transistor 138. Therefore, if this transistor 138 turns on with an input signal (power save signal) S3, the reference voltage of a comparator 136 will become low by resistance RO8, and the temperature control of a fixing assembly will become lower than the time of the transistor 138 turning off. Therefore, the power consumption of a fixing assembly becomes low and will be in a power save condition. Moreover, the reference voltage of a comparator 137 is given with the partial pressure of resistance RO4 and RO5. And since the reference voltage of this comparator 137 is set up quite lower than the reference voltage of said comparator 136, a working heater open circuit of a printer or the temperature fall of the fixing assembly by failure of the drive circuit of a heater is detectable. And one side is inputted into the multiplexer 139 and the output S33 of a comparator 136 is read by the microprocessor 101. In addition, this input signal is used in the sense of detection of the ready state of a fixing assembly. Moreover, another side is used as a driving signal of the fixing assembly heater lamp 333 of drawing 15 .

[0076] 342 is a drum thermo sensor which detects the temperature of the photo conductor 301 neighborhood. The output side of a thermistor 342 is connected to the input of resistance R58 and an operational amplifier 270. Therefore, the resistance of said thermistor 342 also changes with the temperature changes of the photo conductor 301 neighborhood. Therefore, the input voltage of an operational amplifier 270 also changes. When the output voltage of an operational amplifier 270 has the low temperature of a photo conductor 301, and the low battery of temperature is high, the high voltage is outputted, respectively. The operational amplifier 270 serves as a voltage follower, and the output is connected to the input of A/D converter 271. And the output voltage of said operational amplifier 270 is changed into digital value, and a microprocessor 101 is made to read through a multiplexer 139 by A/D converter 271. The temperature data of this photo conductor 301 by which A/D conversion was carried out are used for electrification amendment of the photo conductor 301 mentioned later. 440 is a cassette top / lower-berth adjustment switch, 441 is a cassette / manual bypass adjustment switch, and 442 is the Top Margin adjustment switch.

[0077] Drawing 15 is the detailed block diagram of the drive circuit 115 and the output component 116 in drawing 13 . In drawing 15 , 141 is a development counter motor and the hall motor of DC drive is used. 140 is the driver of said development counter motor, and is performing PLL control. 143 is a fixing assembly motor and the hall motor of DC drive is used. 142 is the driver of said fixing assembly motor 143, and is performing PLL control. 145 is a fan motor for cooling inside the plane, and the hall motor of DC drive is



used. 144 is the driver of said cooling fan motor, and PLL speed control like the above-mentioned development counter and a fixing assembly driver is omitted. 147 is the motor for a drive of the photo conductor drum 301, and is using 4 phase pulse motor. 146 is the driver of said drum motor 147, and has adopted the constant current 1-2 phase excitation method. In addition, generating of vibration of 1200PPS extent is driving the rate in few parts. 149 is a pulse motor by the resist motor which makes the resist roller 329 and the manual bypass roller 327 drive. 148 is the driver of said resist motor and is using the constant-voltage 2 phase excitation method. A rate is 400PPS extent.

[0078] In addition, if a hand of cut is made normal rotation, the resist roller 329 rotates, and if it is made reversed, the manual bypass roller 327 will rotate the resist motor 149. These are transmitted through an one-way clutch.

[0079] 151 is a pulse motor by the feed motor which makes the lower-berth feeding roller 322 and the upper case feeding roller 318 drive. Forward and inverse rotation are transmitted through a one EUI clutch like the above. 150 is the driver of said feed motor 151, and is using constant-voltage 2 phase excitation like said resist Motor Driver 148. A rate is 400PPS extent.

[0080] Before electrification, 302 is an electric discharge lamp from which the residual charge on a photo conductor 301 is removed, and consists of two or more red LED. R10 is current control resistance of said electric discharge lamp 302, and 152 is the driver of the electric discharge lamp 302. 303 is a front [ imprint ] electric discharge lamp for gathering the imprint effectiveness set in front of the imprint charger, and consists of two or more red LED. R11 is current control resistance of said electric discharge lamp before an imprint, and 153 is the driver of said electric discharge lamp before an imprint. 158 is the solenoid of the blade for toner recovery, and a blade 310 will be pressed against a photo conductor 301 if this solenoid is turned on. 154 is DORABA of said blade solenoid 158. 159 is a toner supply motor for supplying a toner to a development counter 307 from a toner hopper, and when this toner supply motor rotates, it supplies a toner to a development counter 307 from said toner hopper. Actuation of this toner supply motor 159 operates according to the output of the probe concentration detection sensor of said drawing 14 . 155 is the driver of said toner supply motor 159. 131 is a MC relay which is interlocked with the same door switch as said drawing 14 , and works, and 156 is the driver. And as shown in drawing 15 , it connects with the contact 163 of the power-source side common \*\*\*\*\* MC relay 131 of the motor which excludes the MC relay 131, a lamp, etc., and another side of the contact is connected to +24VB power source. Therefore, when the MC relay 131 turns on, it has the composition that said motor and lamp can be operated.

[0081] 304 is a charger for electrification and the case of a charger is connected to the ground of an airframe. The wire for corona discharge of a charger is connected to the output terminal of the high voltage power supply 160 for electrification of a high voltage power supply 338, and the ON/OFF signal line S35 of a high-pressure output and the analog-control signal line S36 to which the high-pressure output current is changed are connected to the input of the high voltage power supply for electrification. Moreover, it connects with D/A converter 165, and the analog-control signal line S36 is analog-voltage-ized by D/A converter 165, and controls the output current of said high-voltage power source for electrification by the data of the electrification armature-voltage control data line S37 from a microprocessor 101. The charger for exfoliation and the exfoliation

charger 306 are connected to the output of the high voltage power supply 161 for exfoliation for 306. Said high voltage power supply for exfoliation serves as AC output. The imprint charger for 305 to make a form imprinting the toner with which negatives were developed on the photo conductor 301, and the imprint charger are connected to the output of the high voltage power supply 62 for an imprint. Moreover, as for the high voltage power supply for an imprint, development counter bias power supply is also incorporated in addition to said imprint charger output, and the output line S38 is connected to the development counter magnet roller 308. With this electrical potential difference, bias voltage is impressed to said magnet roller 308, and development bias is given. 33 is heater RAMBU of a fixing assembly, it connects with one side of the power source of AC100V, and one side is. Moreover, another side is connected to the 2nd contact 164 of the MC relay 131, and connection now a cage, and one of these are connected to the heater drive circuit 166. Therefore, the heater lamp 333 operates, only when said MC relay 131 is ON. Moreover, two input signals S33 and S39 are inputted into the heater drive circuit 166, and S33 is a signal from the thermistor 334 in a fixing assembly of said drawing 14 , and is the concentration control signal of a fixing assembly. S39 is the compulsive OFF signal of the heater lamp 333 from a microprocessor 101.

[0082] Drawing 16 is the laser scanning motor 312 in drawing 13 , and the detail circuit diagram of the drive circuit 118. In drawing 16 , 312 is a circuit diagram inside a laser scanning motor. L02, L03, and L04 show the coil of a motor, and 180,181,182 is a hall device which detects the location of the rotator of a motor, respectively. 183,184,185 is a comparator for said hall device 180,181,182, and the output is connected to the base of the power transistor 171,172,173 which drives said motor coils L02, L03, and L04 in the drive circuit 118 through resistance R26, R27, and R28. Moreover, between the base of said power transistor 171,172,173, and an emitter, base resistance R23, R24, and R25 is connected, respectively. Said hall device 180,181,182 is turned on in order of 180,181,182 with rotation of the rotator of a motor. Therefore, the output of a comparator 183,184,185 is also set to LOW level at the order of 183,184,185. Therefore, the laser scan motor 312 rotates by turning on a power transistor at the order of 173,172,171, and impressing driver voltage in order of L02, L03, and L04. Moreover, the output of a comparator 185 lets diode D02 pass, and is inputted into the dividing counter 175 through the waveform shaping circuit by resistance R30 and the capacitor C06, and the inverter 174. The output of the outgoing ends Q1 and Q2 of the dividing counter 175 is connected to the motor-velocity change-over gate 176,177, and the output of said speed change-over gate is connected to FG input of the PLL (phase . lock . loop formation) control IC through the OR gate 178. Moreover, the output and its reversal output of the speed control signal line S40 are connected to one input of said speed change-over gate 176,177. Therefore, when S40 is LOW level, the change-over gate 177 becomes effective, the output of Q1 of a dividing counter is inputted into FG of said PLL control IC 167, when S40 is HIGH level, the change-over gate 176 becomes effective, and 175Qdividing counter 2 output is inputted into FG input of the PLL control IC 167. If the I/O signal of the PLL control IC 167 is explained briefly here, a P/S terminal (PLAY/STOP) will be stopped on HIGH level, and will be started on LOW level. In the case of HIGH level, the both-ends child paragenesis force of AGC and APC serves as HIGH level. When the Xtal criteria dividing output signal and CPIN have in a reference

frequency input by the lock detecting signal and the rotary motor pulse signal input from the motor which FGIN controls, the signal with which N1 and N2 switch the number of dividing of the criteria counting-down circuit inside this IC, and 33/45 have LD in rotational frequency's of motor lock within the limits, as for the change-over signal of the rotational frequency of a motor, and CPOUT, HIGH level is outputted, and LOW level is outputted except it. In the speed-control system output of a motor, AFC is a 8-bit D/A converter output inside PLLIC, and APC is a 8-bit D/A converter output inside PLLIC with the phase control system output of a motor. Moreover, the quartz resonator for reference frequency generating in X01 connected to PLLIC167, and C01 and C02 are the capacitors for an oscillation.

[0083] AFC of IC167 for PLL control and the output terminal of APC constitute an adder circuit from resistance R12 and R13, and are connected to - side input terminal of an operational amplifier 168. The electrical potential difference which pressured +12V partially by resistance R14 and R15 is impressed to + side input terminal of an operational amplifier 168. Moreover, the negative feedback circuit is constituted from resistance R16 and a capacitor C03, and especially the capacitor C03 carries out the duty of a high-pass filter. Therefore, the amplification degree of an operational amplifier 168 has given the property to decrease to the input more than a certain frequency. The output of an operational amplifier 168 is connected to + input terminal of the servovalve switching regulator IC 169. 169 is the servovalve switching regulator IC of a common commercial item. The down switching regulator circuit consists of a book IC 169, and a power transistor 170, diode D01, a coil L01 and a capacitor C05. In I/O of IC169, - terminal is a comparison reference voltage terminal, and the reference voltage which pressured partially the electrical potential difference of the reference voltage output terminal VREF of the IC169 interior by resistance R17 and R18 is impressed. A DEADTIME terminal regulates the greatest pulse width of an output, and the electrical potential difference which pressured said VREF partially by resistance R19 and R20 is impressed. C1 and C2 are output terminals, and pulse width changes according to the electrical-potential-difference value of + input terminal. That is, if + side input terminal electrical potential difference is lower than - side input terminal electrical potential difference, the pulse width by the side of the LOW level of C1 and C2 will become small, and the width of face which a power transistor 170 turns on will become small similarly. Therefore, the both-ends electrical potential difference of a capacitor C05 also becomes small. Moreover, if + side input terminal electrical potential difference is higher than - side input terminal electrical potential difference, contrary to the above, the pulse width of C1 and C2 will become large, and the both-ends electrical potential difference of a capacitor C05 will also become large.

[0084] The revolving speed control of the scanning motor 312 is explained below.

[0085] Since AFC of IC167 for PLL control and both the outputs of APC serve as LOW level until the above-mentioned lock signal S41 is outputted if the rotation start signal S42 of the scanning motor 312 is set to LOW level, as for the output of an operational amplifier 168, the electrical potential difference of HIGH level is outputted. Therefore, in the output pulse width of face of a regulator IC 169, the both-ends electrical potential difference of the large next door capacitor C05 becomes about abbreviation +16V. And since any one of said the hall devices 180,181,182 is turned on in the location which the rotator of a motor has stopped, the coil corresponding to said hall device 180,181,182 is

excited among the motor coils L02, L03, and L04, and, as for the scanning motor 312, rotation is begun. And the scanning motor 312 brings rotation forward and goes. Now, since the level of the speed control signal line S40 is HIGH, 175Qdividing counter 2 output is applied to FG input terminal of the PLL control IC 167. Therefore, the dividing counter 175 is working as eight frequency dividers. When the frequency of the signal added to FGIN reaches about 96% of the reference frequency of the PLLIC169 interior, it is the lock signal LD. S41 is set to HIGH and AFC and an APC output level switch to the output voltage of the interior D/A converter of PLLIC instead of LOW level (OV) immobilization. Therefore, the scanning motor 312 becomes a fixed speed and appearance control is carried out by the speed-control system output AFC and the phase control system output APC henceforth.

[0086] Moreover, when the command of a fixed time amount (about 5 minutes) print which is this example does not come from the data control section 2, a scanning motor will be in a standby condition and the output of the speed control line S40 will be set to LOW level. Therefore, since a counting-down circuit 175 serves as 4 dividing from 8 front dividing, a scanning motor becomes the rotational frequency of  $4/8$ ,  $1/2$  [ i.e., ]. When long duration high-speed rotation is being performed, in order for this to prevent integrity problems, such as bearing of a motor, occurring, it is performing the above half-speed control. In addition, in this example, it is about 12,000 rpm at the time of printing actuation, i.e., high-speed rotation, and is about 6000 rpm at the time of standby.

[0087] Drawing 17 is the detail circuit diagram of the laser modulation circuit 120 and semiconductor laser 344 in drawing 13 . In drawing 17 , the configuration consists of the laser diode 259 which emits light, and the photodiode 260 for monitors which is the photodetection means which acts as the monitor of the output beam reinforcement from laser diode 259 with the light beam generating means slack semi-conductor laser diode whose 344 is a light beam generating means. 257 is a voltage-current conversion means.

#### DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the system block Fig. showing the relation of the equipment and the external device in this invention.

[Drawing 2] It is the outline sectional view of the printing control section (printer) in said system chart.

[Drawing 3] It is the outline perspective view showing the relation of the laser-scanner unit and the photo conductor for record in drawing 2 .

[Drawing 4] It is the schematic diagram showing the feed part in drawing 2 .

[Drawing 5] It is the schematic diagram showing an example of the delivery unit in drawing 2 .

[Drawing 6] It is the top view showing the control-panel section of this example equipment.

[Drawing 7] It is the expansion top view of the display in drawing 6 .

[Drawing 8] It is the block diagram showing an example of the data control section of drawing 1 .

[Drawing 9] It is the format Fig. of the data dealt with in the data control section.

[Drawing 10] It is the format Fig. of the data dealt with in the data control section.

[Drawing 11] It is the correspondence Fig. of the field of the Records Department of data

control circles, and a form.

[Drawing 12] It is the format Fig. of the data dealt with in the data control section.

[Drawing 13] It is the block diagram of the printing control section in drawing 1 .

[Drawing 14] It is the detail circuit diagram of each detector in drawing 13 .

[Drawing 15] It is the block diagram showing the detail of the drive circuit in drawing 13 , and an output component.

[Drawing 16] It is the circuit diagram showing the detail of the motorised circuit in drawing 13 , and a laser scanning motor.

[Drawing 17] It is the detail circuit diagram showing the laser modulation circuit and semiconductor laser in drawing 13 .

[Drawing 18] It is the property Fig. showing \*\*\*\* of semiconductor laser and an optical output.

[Drawing 19] It is the property Fig. showing \*\*\*\* of semiconductor laser and an optical output.

[Drawing 20] It is a timing diagram for explanation of the circuit of drawing 17 of operation.

[Drawing 21] It is the detail circuit diagram showing the beam detector and beam detector in drawing 13 .

[Drawing 22] It is a wave form chart for explanation of the circuit of drawing 21 of operation.

[Drawing 23] It is drawing showing an example of the structure of said beam detector.

[Drawing 24] It is a wave form chart for explanation of the circuit of drawing 21 of operation.

[Drawing 25] It is the detail circuit diagram of the printing data write control circuit in drawing 13 .

[Drawing 26] It is the circuit diagram of the interface circuitry in drawing 13 .

[Drawing 27] It is the related Fig. of the abbreviated name of the command used for this example equipment, and a function.

[Drawing 28] It is the explanatory view showing the contents of the status used for this example equipment.

[Drawing 29] They are related Figs., such as a beam scan location to the record photo conductor in drawing 3 , and a write-in location of data.

[Drawing 30] It is the top view showing the printing area part of the whole form surface including the paper size of drawing 29 .

[Drawing 31] It is a timing diagram for explanation of the circuit of drawing 25 of operation.

[Drawing 32] It is a timing diagram for explanation of the circuit of drawing 25 of operation.

[Drawing 33] It is the printing pattern Fig. printed by the form.

[Drawing 34] It is the printing pattern Fig. printed by the form.

[Drawing 35] It is the property Fig. showing the relation between the exposure location for explaining the exposure control action in the circuit of drawing 25 , exposure energy and surface potential and exposure energy, and an exposure location.

[Drawing 36] It is the property Fig. showing the relation between the exposure location for explaining the exposure control action in the circuit of drawing 25 , exposure energy and surface potential and exposure energy, and an exposure location.

[Drawing 37] It is the detail block diagram of the high voltage power supply for electrification in drawing 15 .

[Drawing 38] It is a property Fig. for explaining actuation of the circuit of drawing 37 .

[Drawing 39] It is a property Fig. for explaining actuation of the circuit of drawing 37 .

[Drawing 40] It is a property Fig. for explaining actuation of the circuit of drawing 37 .

[Drawing 41] It is a property Fig. for explaining actuation of the circuit of drawing 37 .

[Drawing 42] It is the schematic diagram showing the relation of the laser-scanner unit and record photo conductor in said drawing 2 .

[Drawing 43] It is the explanatory view showing the relation between a record photo conductor and a form.

[Drawing 44] It is the side elevation showing the modification of a paper output tray shown in said drawing 5 .

[Drawing 45] It is the detail drawing of the data recorded in each recording apparatus in drawing 13 .

[Drawing 46] It is the detail drawing of the data recorded in each recording apparatus in drawing 13 .

[Drawing 47] It is a flow chart for explaining actuation by the whole this example equipment.

[Drawing 48] It is a flow chart for explaining actuation by the whole this example equipment.

[Drawing 49] It is a flow chart for explaining actuation by the whole this example equipment.

[Drawing 50] It is a flow chart for explaining actuation by the whole this example equipment.

[Drawing 51] It is a flow chart for explaining actuation by the whole this example equipment.

[Drawing 52] It is a flow chart for explaining actuation by the whole this example equipment.

[Drawing 53] It is a flow chart for explaining actuation by the whole this example equipment.

[Drawing 54] It is a flow chart for explaining actuation by the whole this example equipment.

[Drawing 55] It is a flow chart for explaining actuation by the whole this example equipment.

[Drawing 56] It is a flow chart for explaining actuation by the whole this example equipment.

[Drawing 57] It is a flow chart for explaining actuation by the whole this example equipment.

[Drawing 58] It is a flow chart for explaining actuation by the whole this example equipment.

[Drawing 59] It is a flow chart for explaining actuation by the whole this example equipment.

[Drawing 60] It is a timing diagram for explanation of this example equipment of operation.

[Drawing 61] It is a timing diagram for explanation of this example equipment of operation.

[Drawing 62] It is a timing diagram for explanation of this example equipment of operation.

[Drawing 63] It is a flow chart for explaining actuation of this example equipment.

[Drawing 64] It is the related Fig. showing contents with the number of the equipment in this example equipment.

[Drawing 65] It is the related Fig. showing contents with the number of the equipment in this example equipment.

[Drawing 66] It is the related Fig. showing contents with the number of the equipment in this example equipment.

[Description of Notations]

120 Laser Modulation Circuit

236 Analog Switch

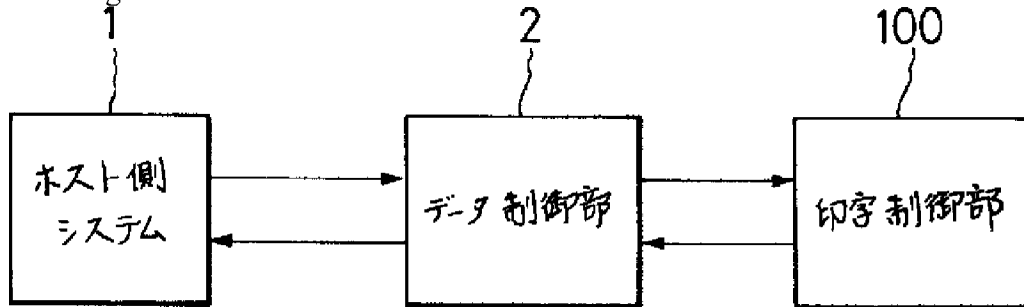
259 Laser Diode

260 Photodiode

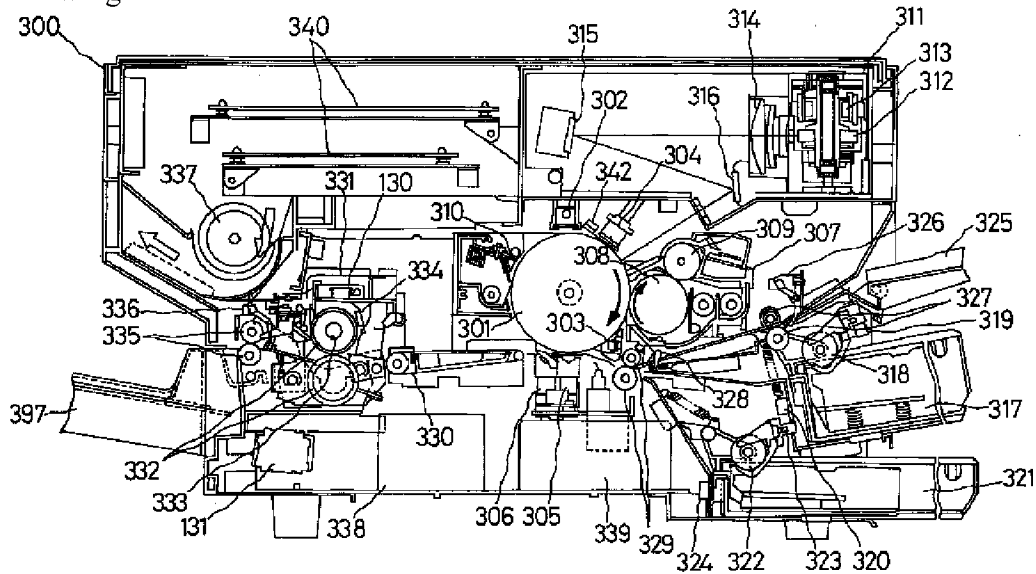
257 High-frequency Transistor

344 Semiconductor Laser

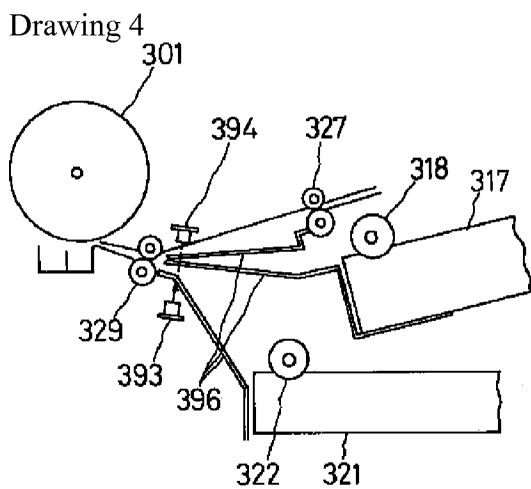
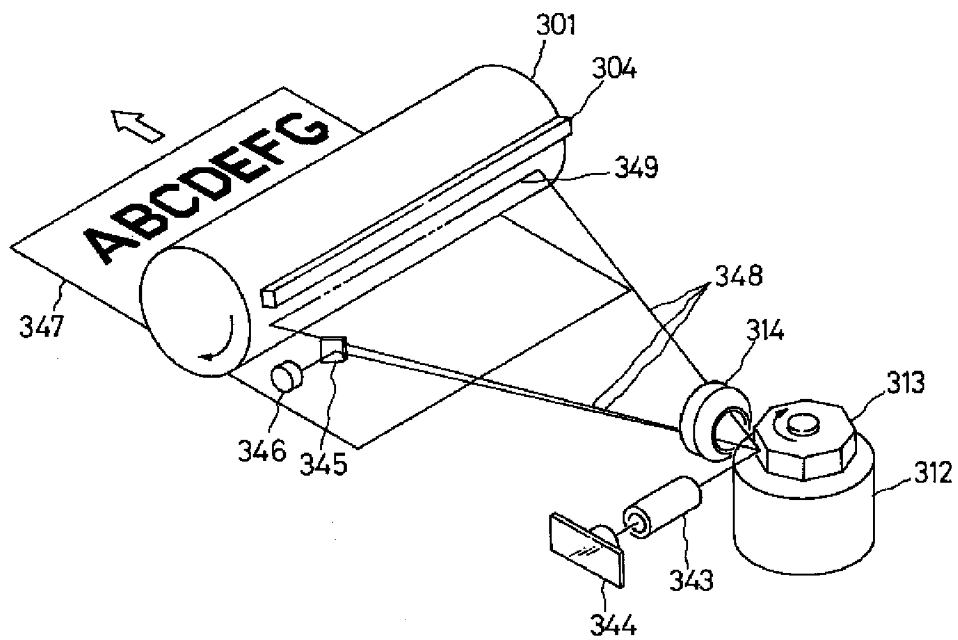
Drawing 1



Drawing 2

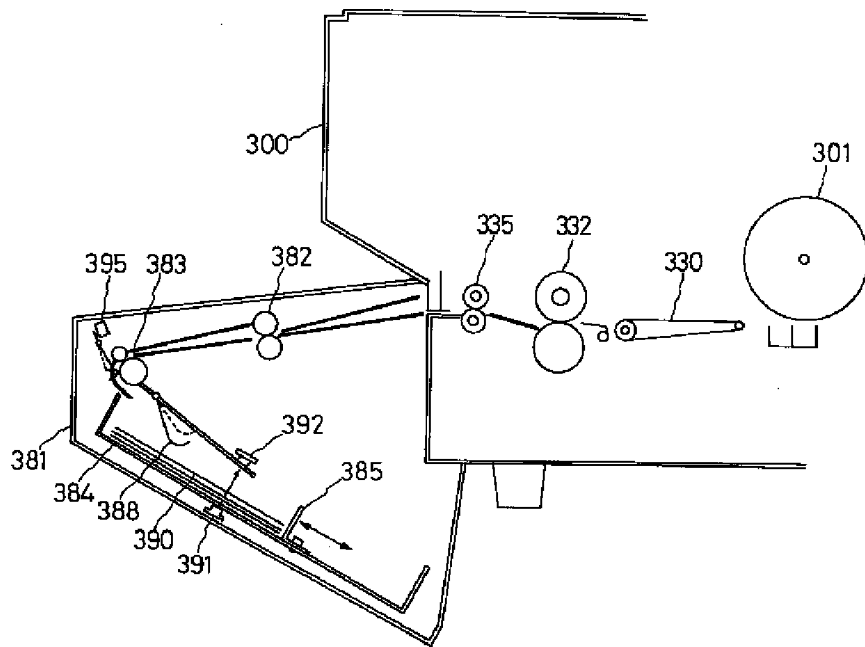


Drawing 3

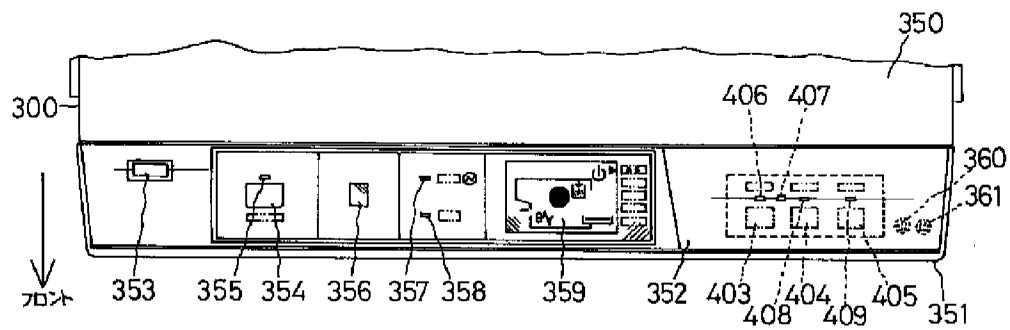


Drawing 5

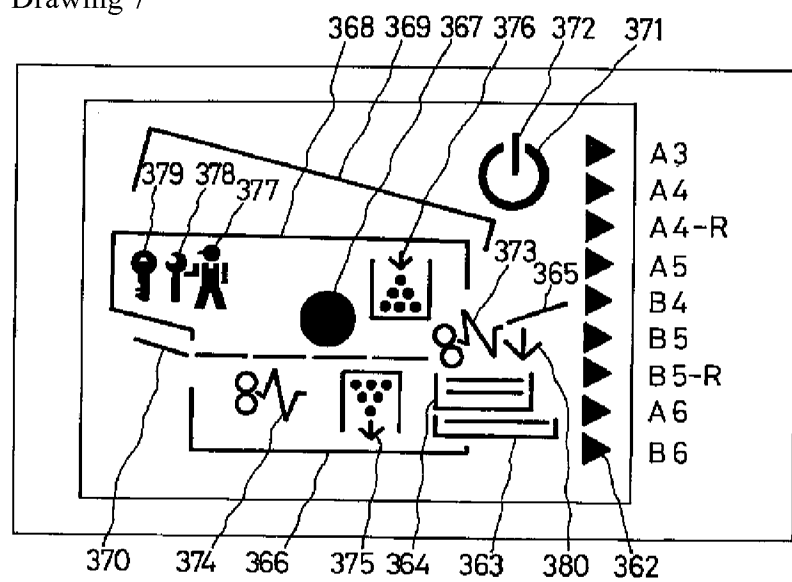




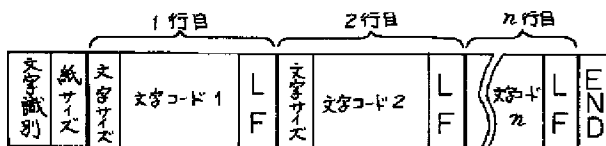
Drawing 6



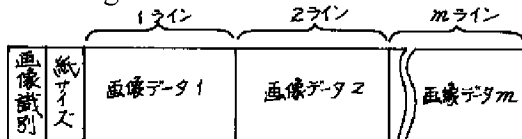
Drawing 7



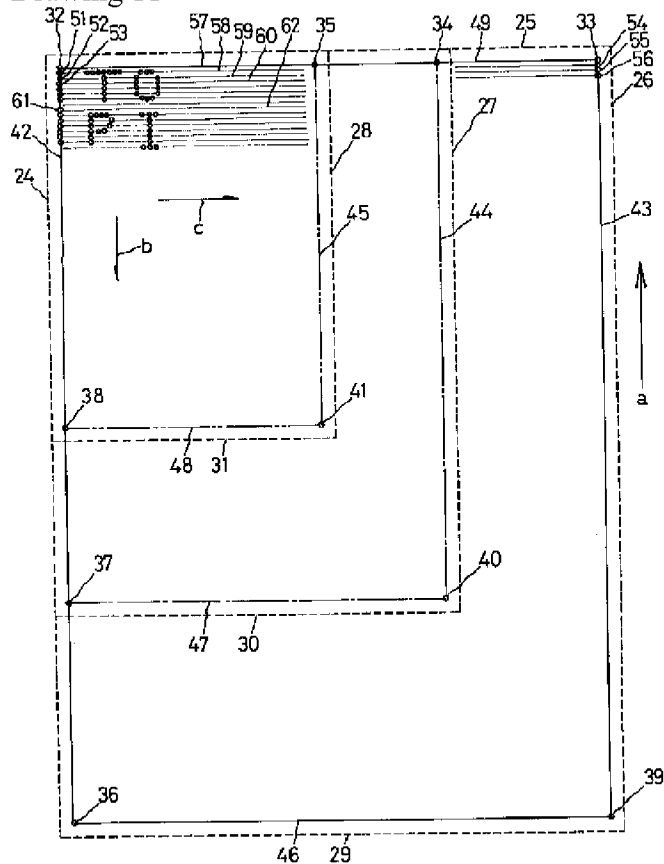
Drawing 9



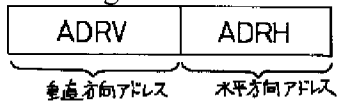
Drawing 10



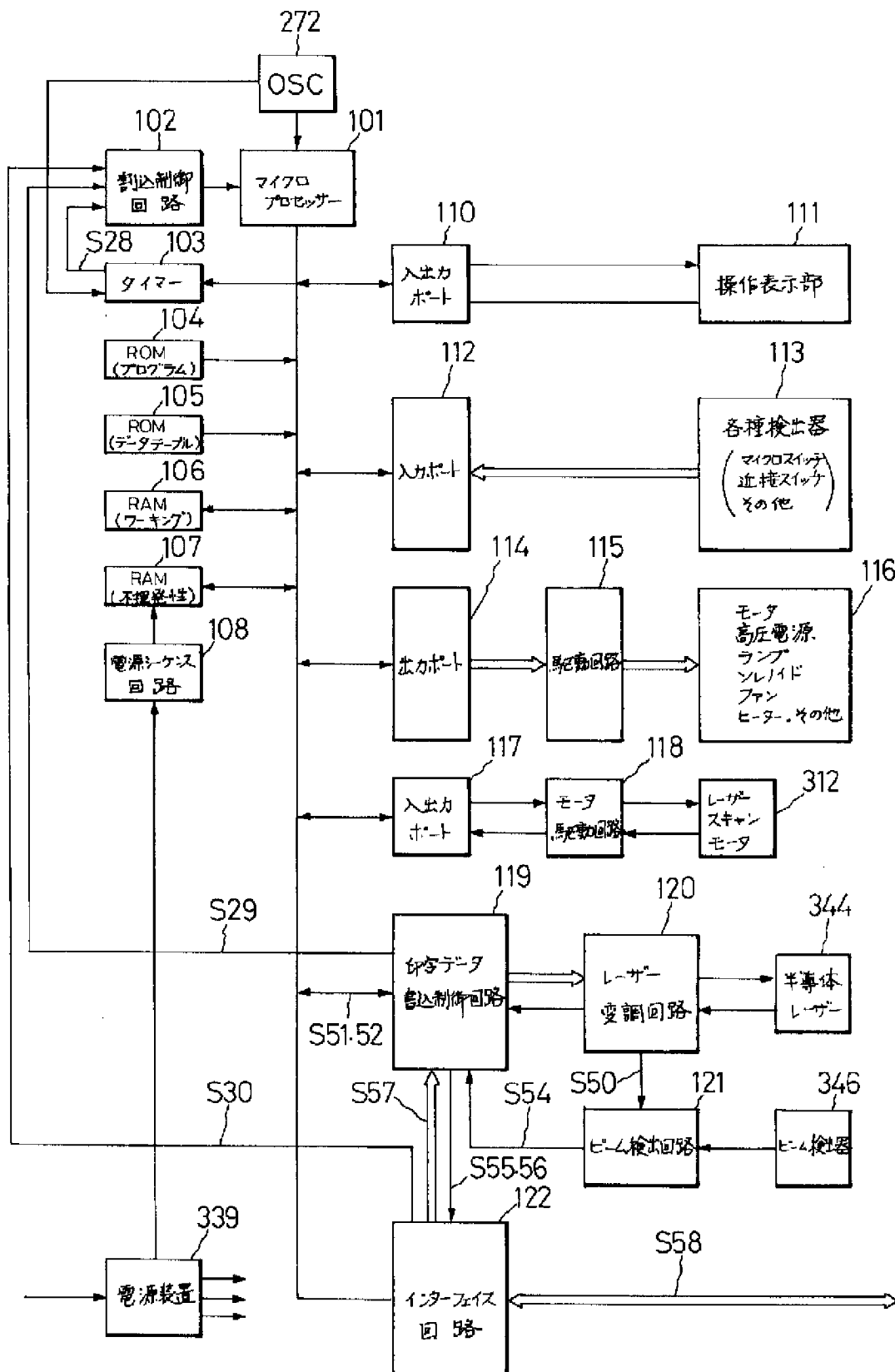
Drawing 11



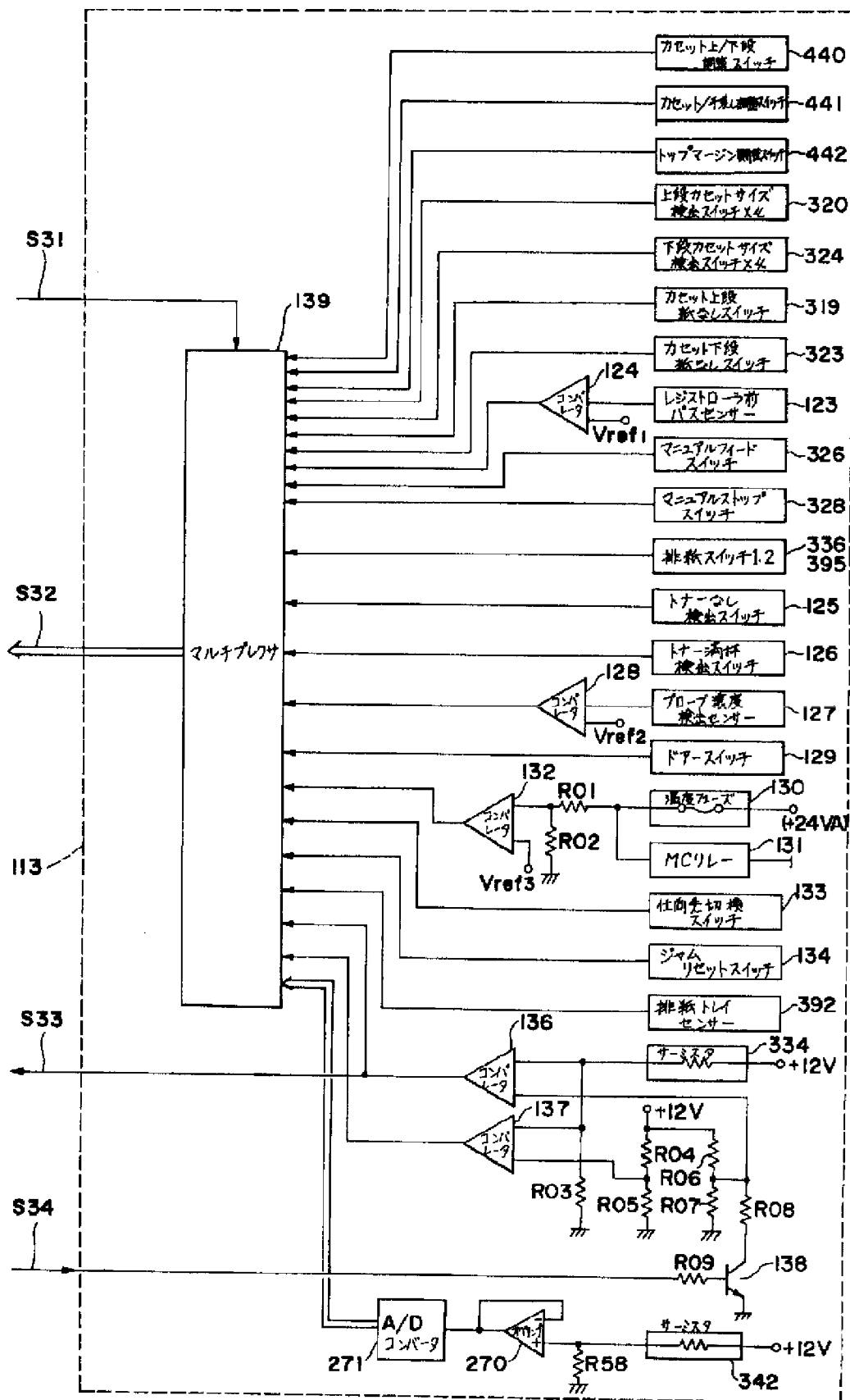
Drawing 12



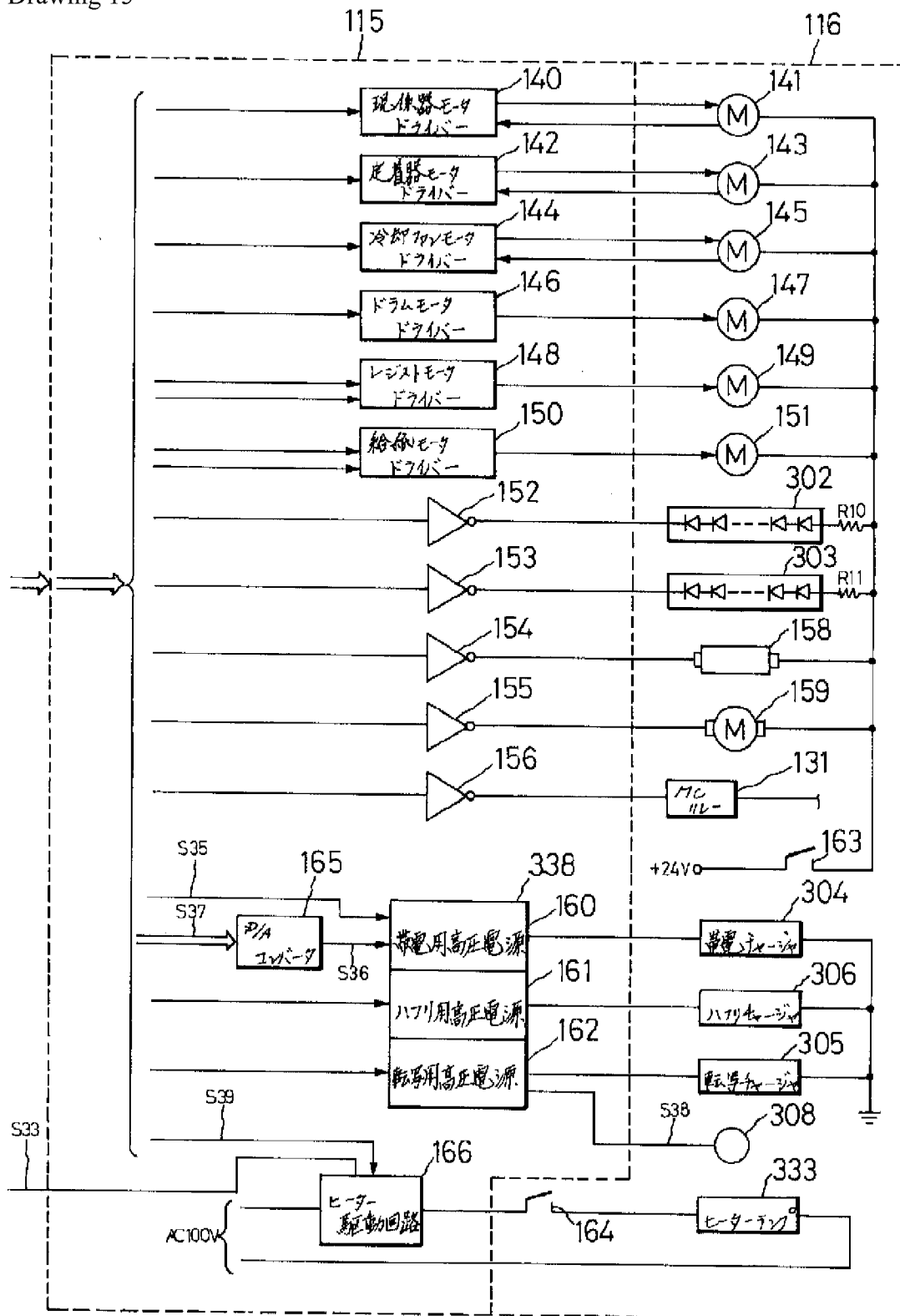
Drawing 13



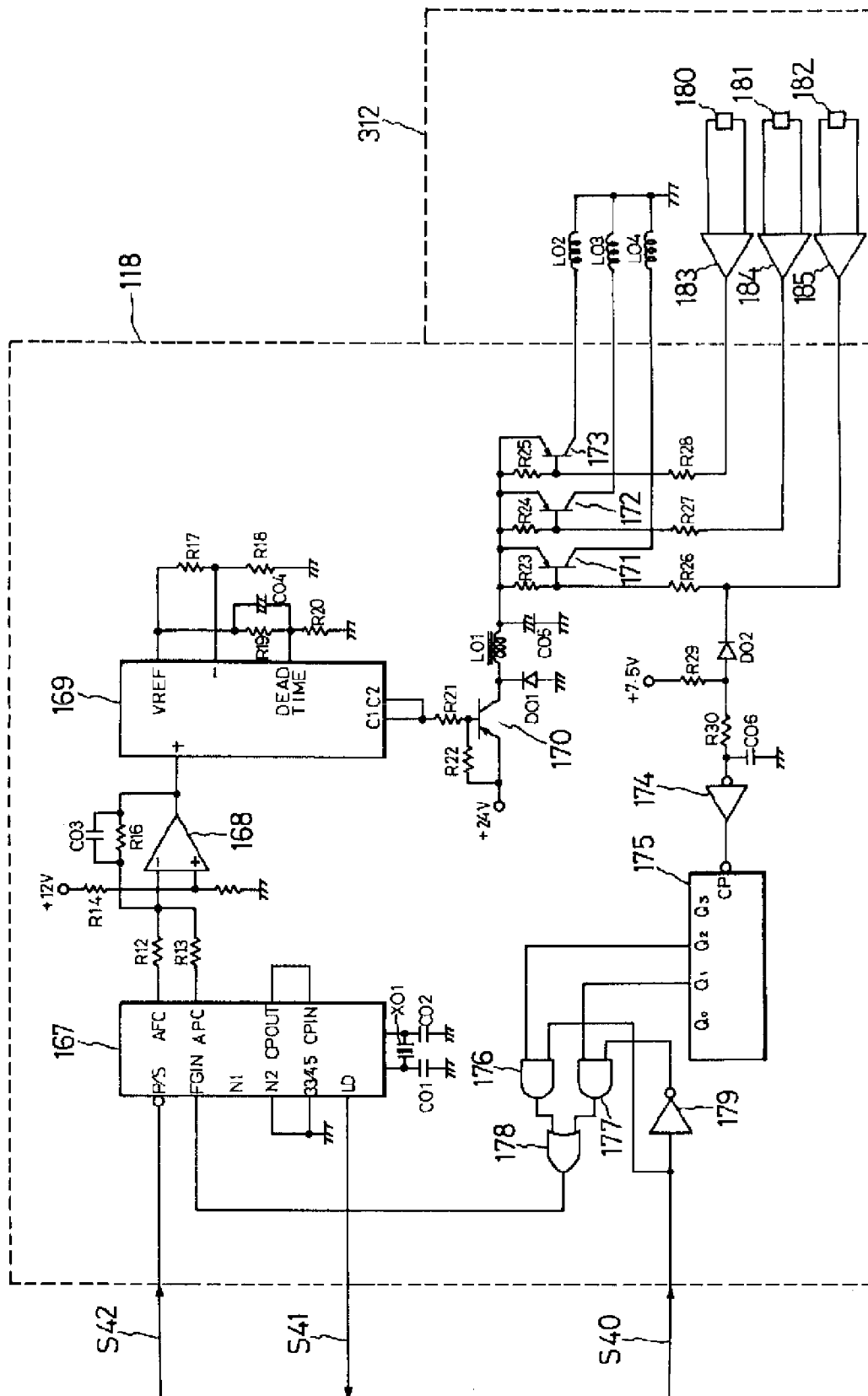
Drawing 14



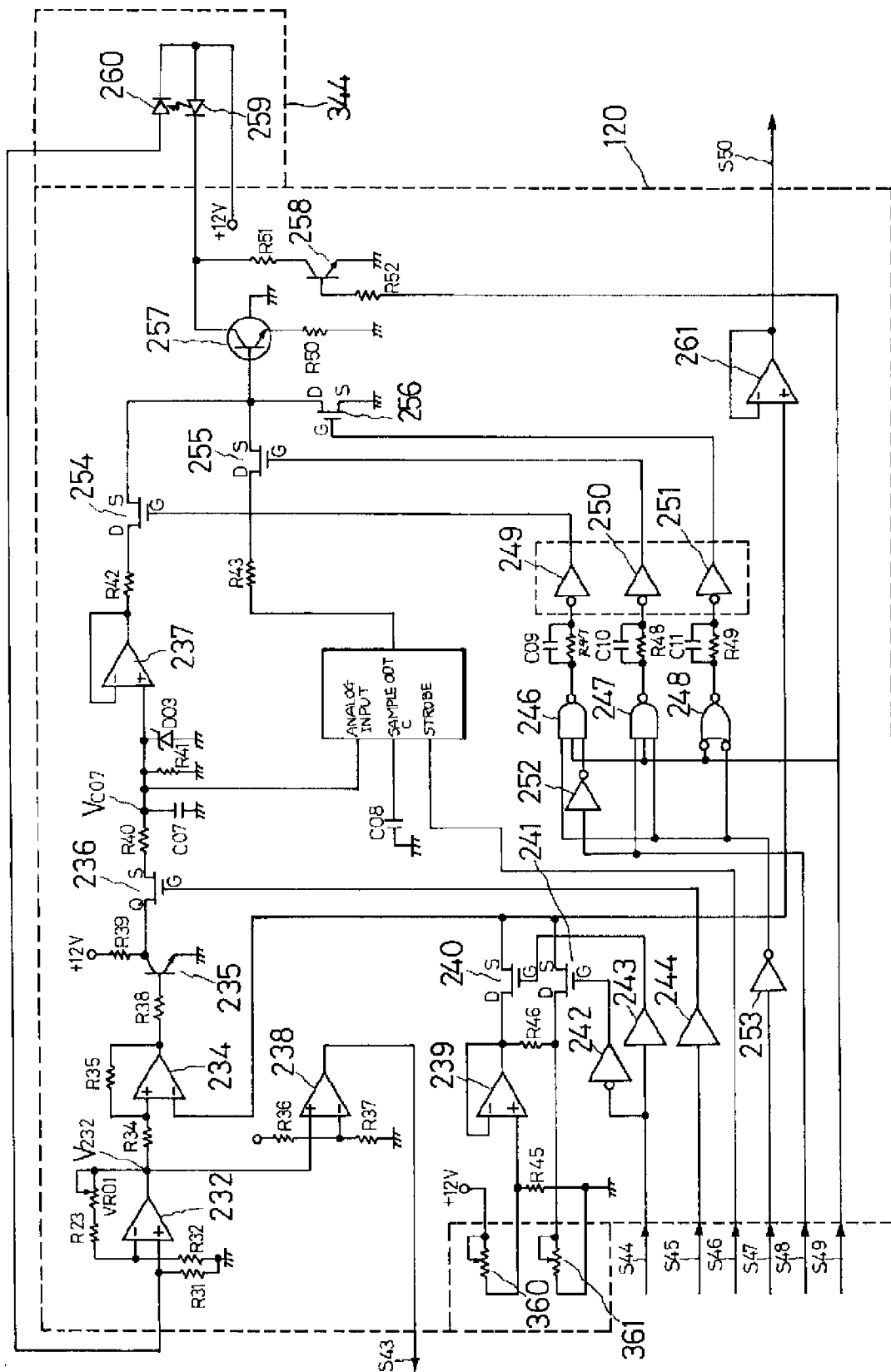
Drawing 15



Drawing 16

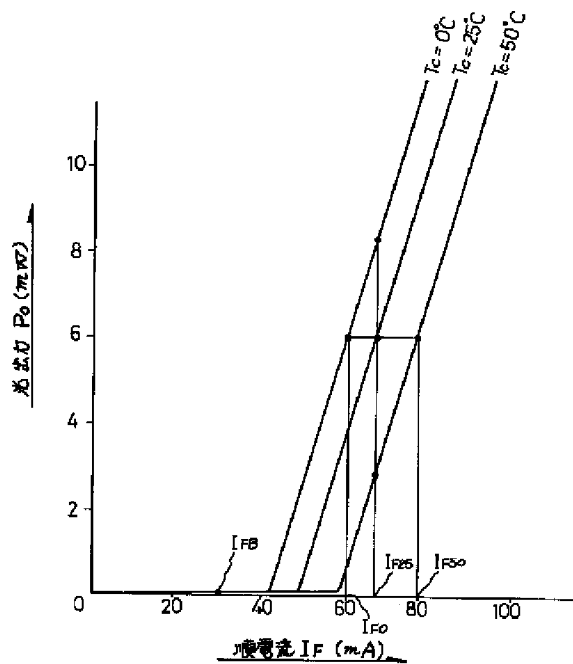


Drawing 17

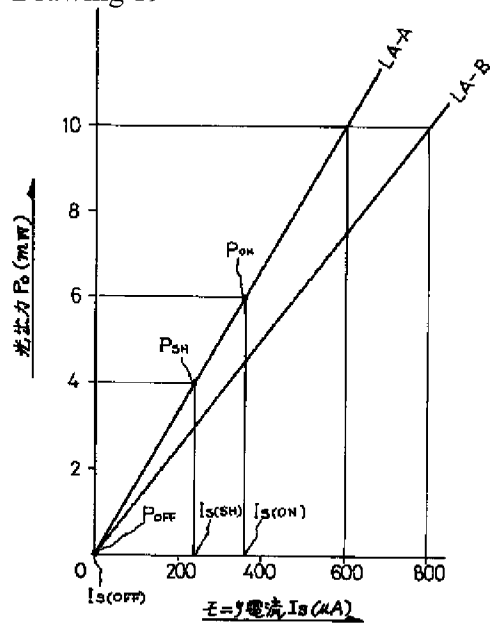


Drawing 18

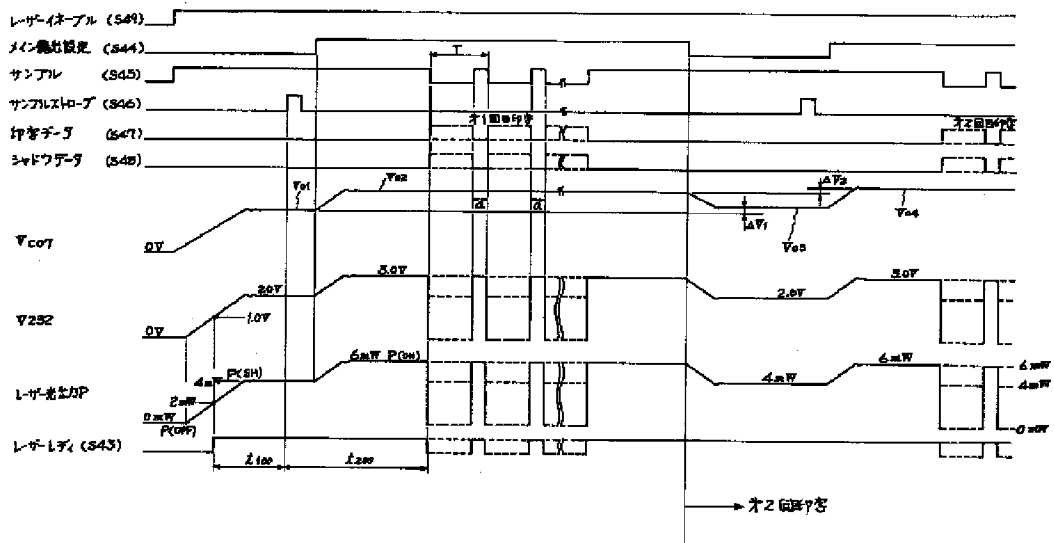




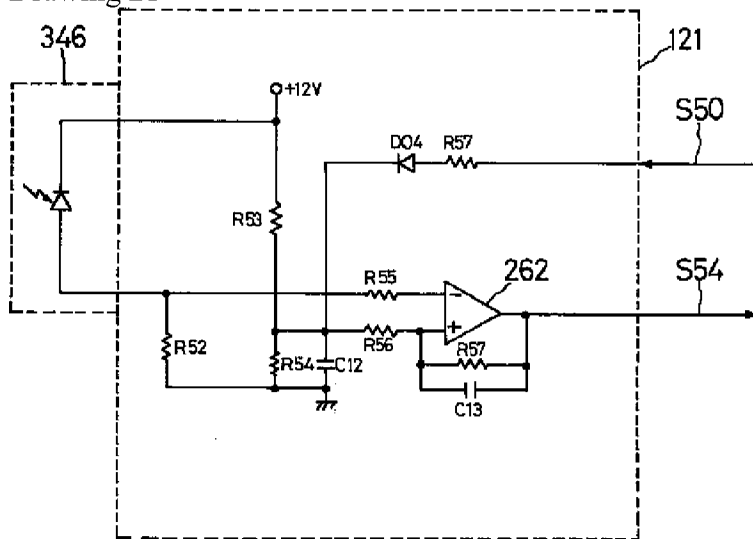
Drawing 19



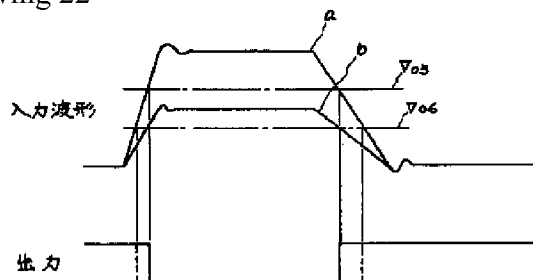
Drawing 20



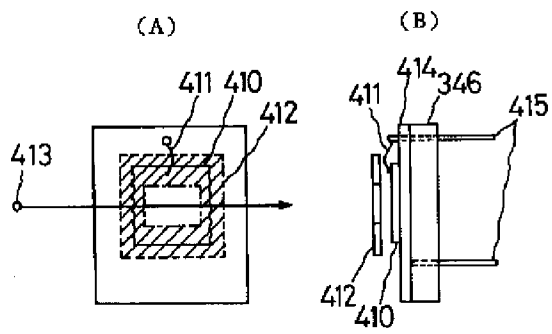
Drawing 21



Drawing 22



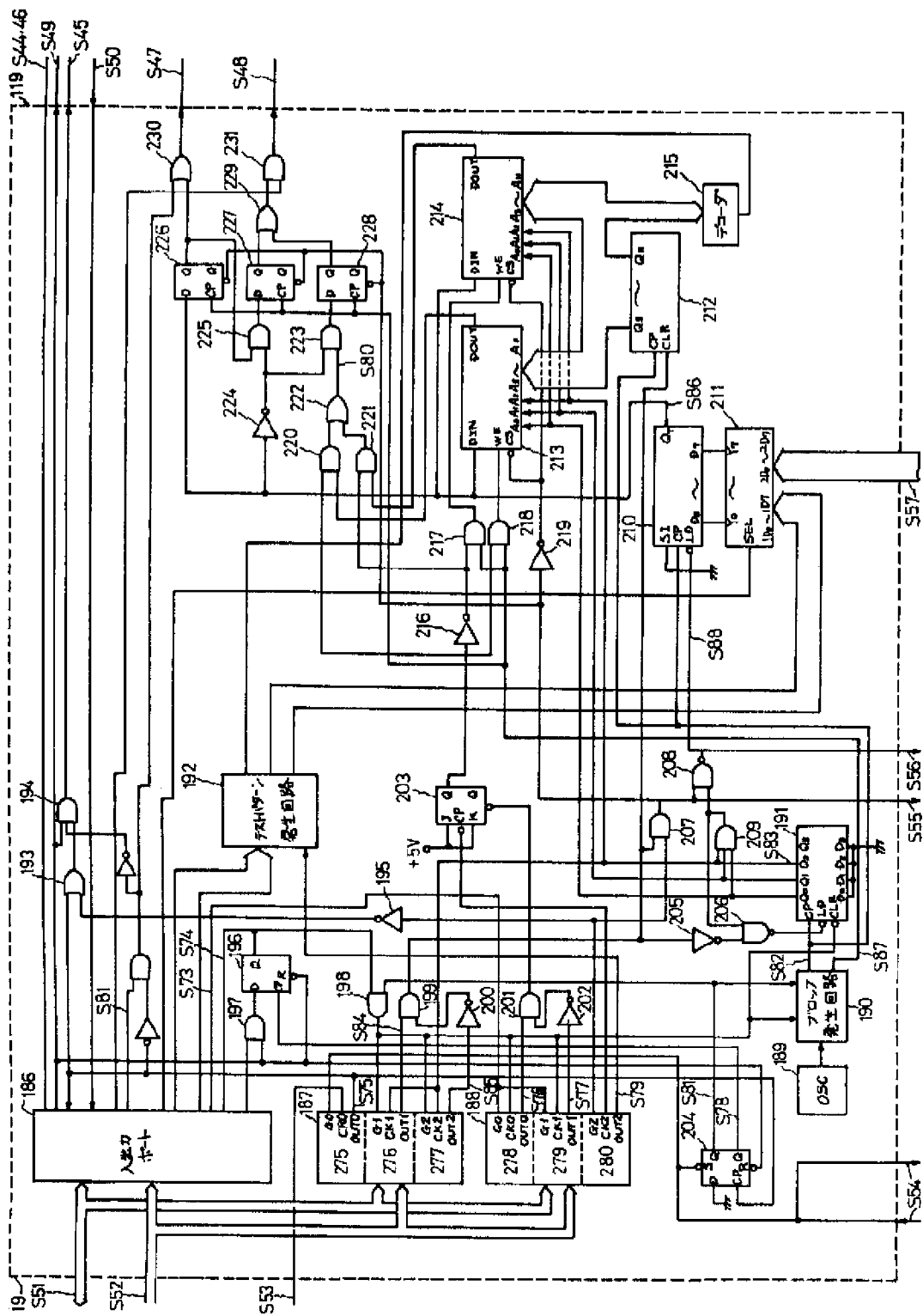
Drawing 23



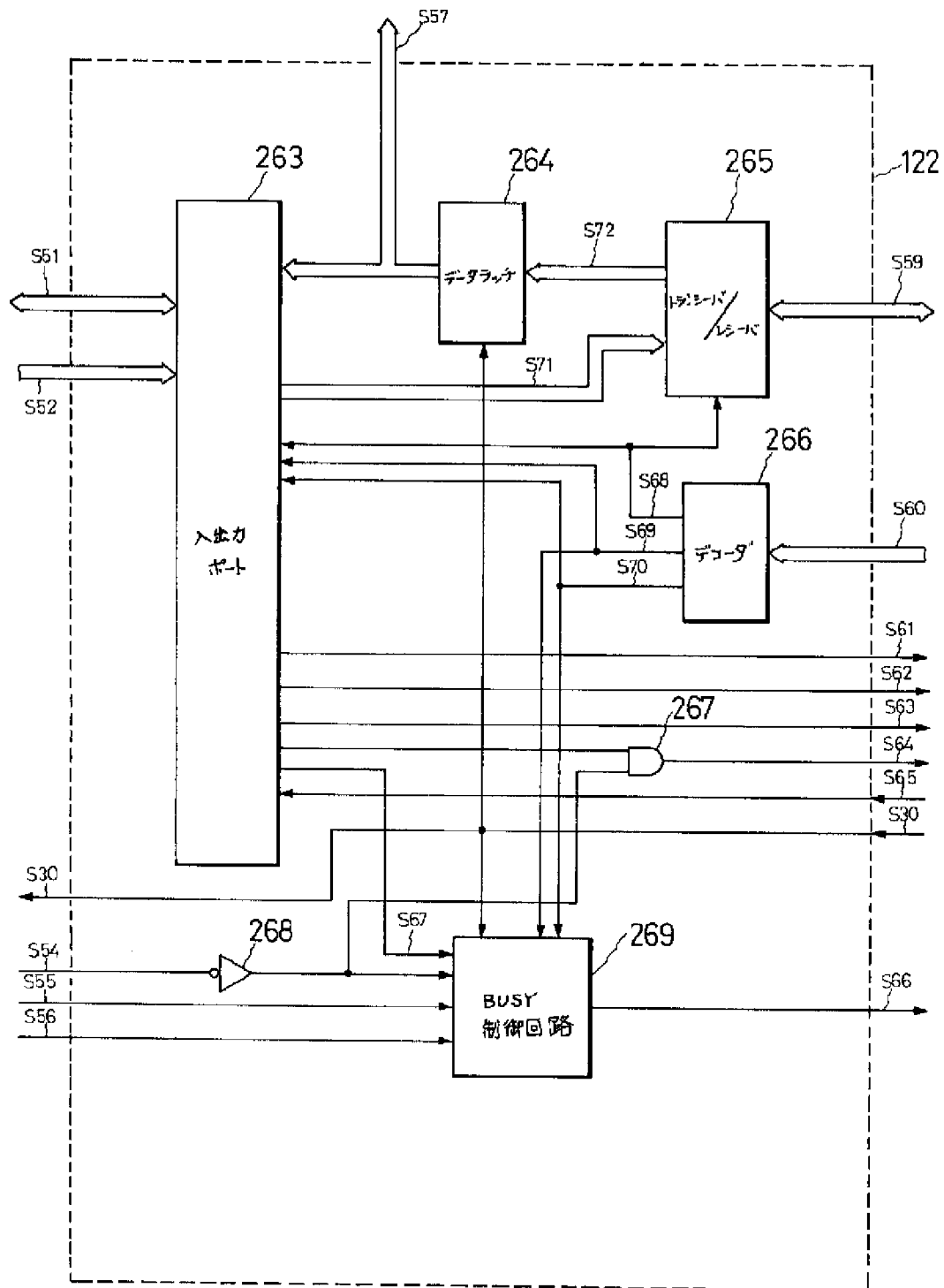
Drawing 24



Drawing 25



Drawing 26



Drawing 27

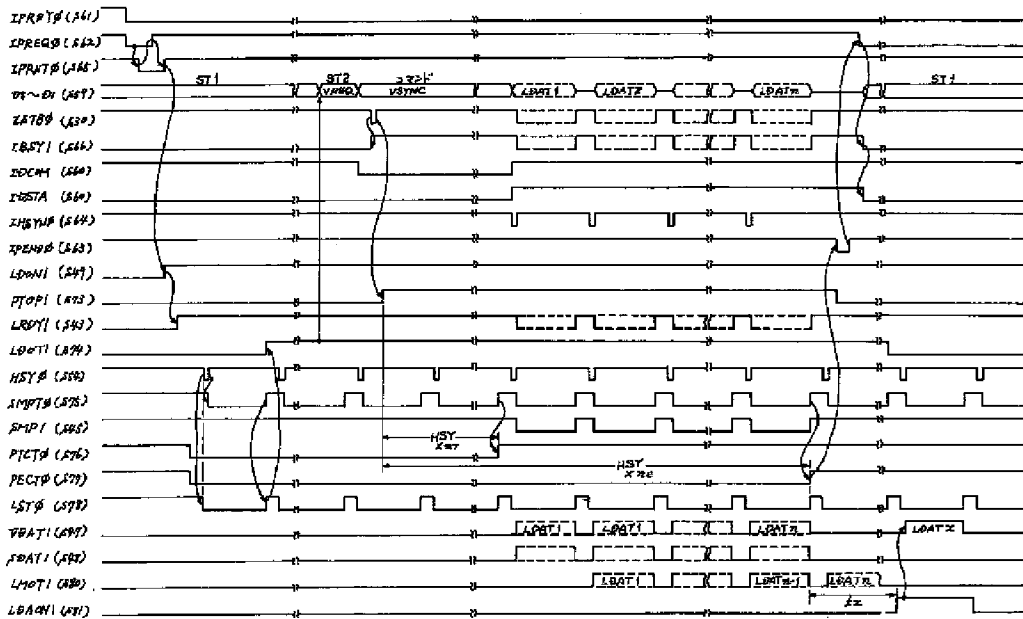
コマンド略称	機 能
SR 1	ステータス 1 要求
" 2	" 2 "
" 3	" 3 "
" 4	" 4 "
" 5	" 5 "
" 6	" 6 "
PSON	パワーセーブ
PSOF	パワーセーブ 解除
CSTU	カセット上段 指定
CSTL	" 下段 指定
SELON	セレクトランプ 点灯
SELOF	" 消灯
VSYNC	画像データ転送開始
MF 1	手差し指定 ( A3 サイズ )
" 2	" ( A4 サイズ )
" 3	" ( A4 ヨコ )
" 4	" ( A5 サイズ )
" 5	" ( A6 サイズ )
" 6	" ( B4 サイズ )
" 7	" ( B5 サイズ )
" 8	" ( B5 ヨコ )
" 9	" ( B6 サイズ )
TBM 1	トップ/ボトムマージン ( 5mm )
" 2	" ( 10mm )
" 3	" ( 15mm )
" 4	" ( 20mm )
SONF	シャドウ ON / OFF

Drawing 28

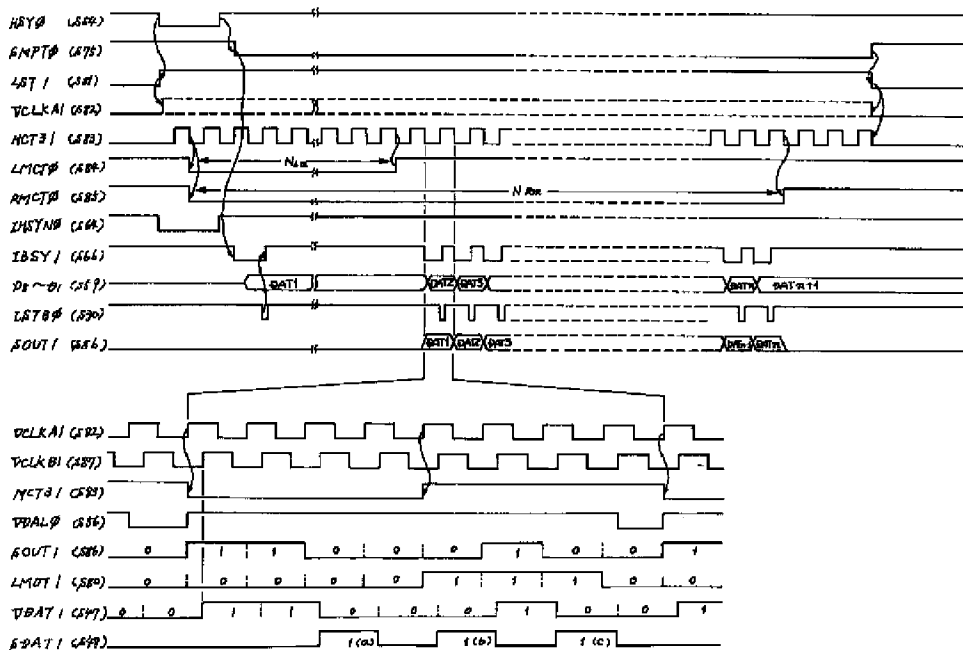
	DATA 81	DATA 71	DATA 61	DATA 51	DATA 41	DATA 31	DATA 21	DATA 11
ステータス1	不正 コマ ンド エラ ー	紙搬送中	セレクトスイッチ ON	VSYNC リクエスト	手差し	カセット上段/横	トップ/ボトムマージン	
ステータス2		シャドウON	カセットサイズ（上段）			カセットサイズ（下段）		
ステータス3		—	テスト/メンテナンス 中	データ再送要求	ウェイト中	パワーセーブ中	オーバーコール	サービスマン コール
ステータス4		トレイフル	トナーパック 交換	紙切れ	紙ジャム	トナー切れ	カバーオープン	—
ステータス5		タイミングエラー	定着器故障	レーザー故障	スキャンセンタ 故障	ヒートローラ 交換	ドラム交換	現像剤交換
ステータス6		—	—	—	—	再送枚数		

Drawing 29



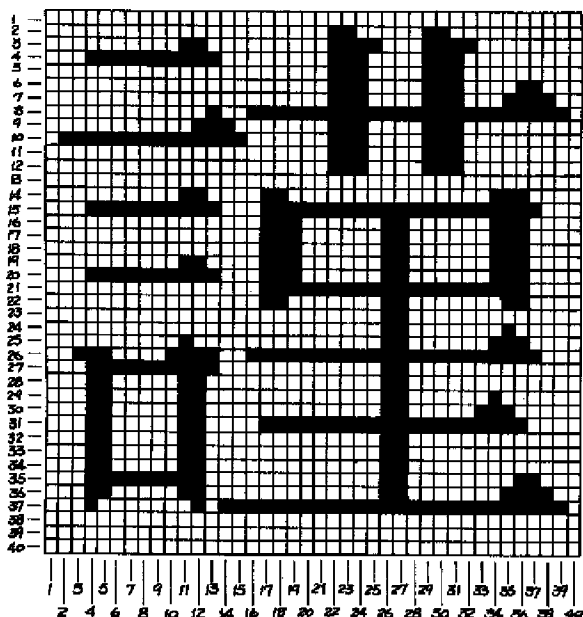


Drawing 32

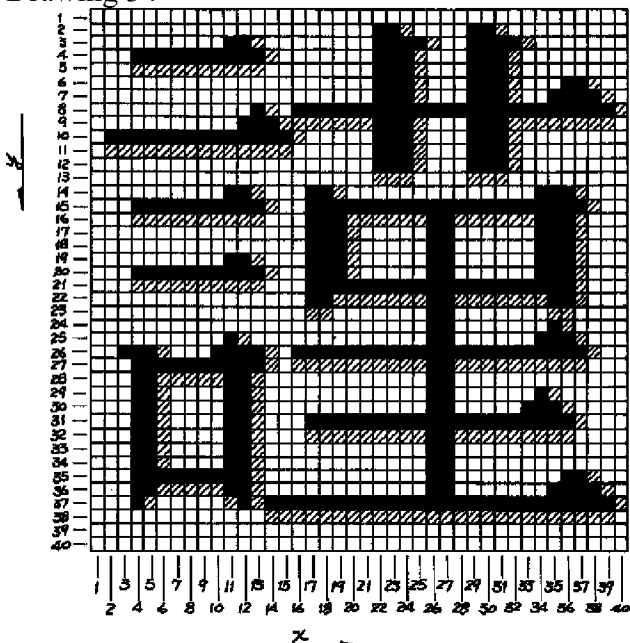


Drawing 33

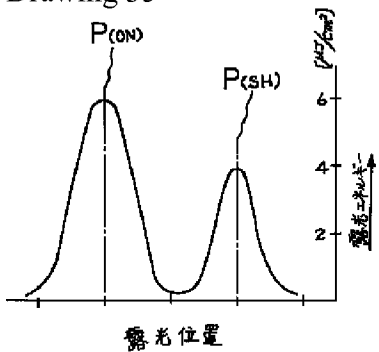




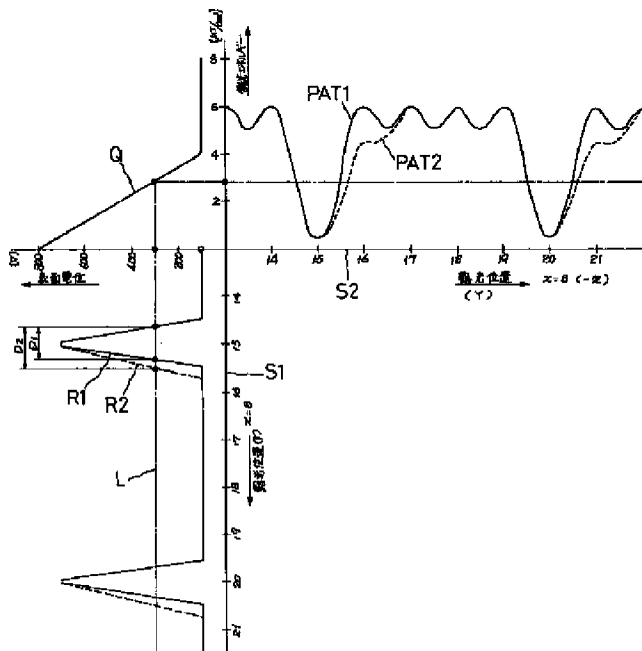
Drawing 34



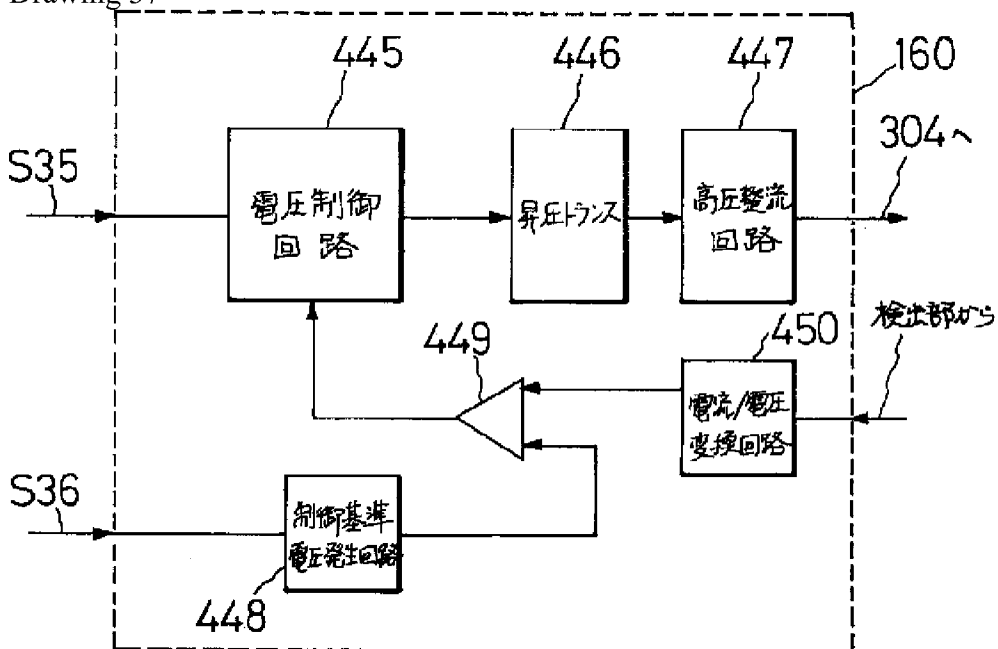
Drawing 35



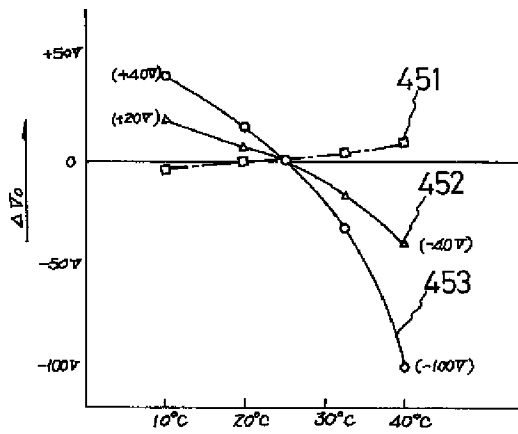
Drawing 36



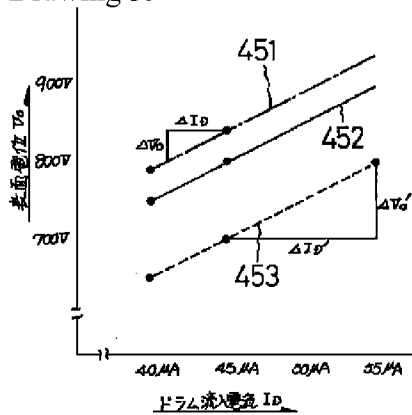
Drawing 37



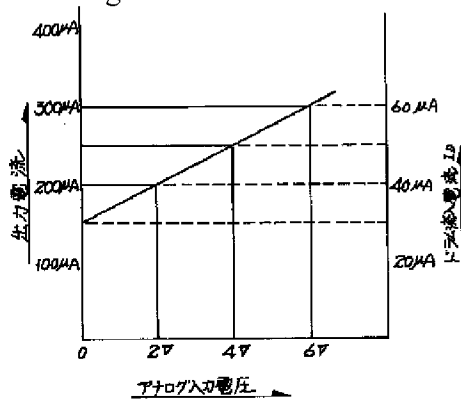
Drawing 38



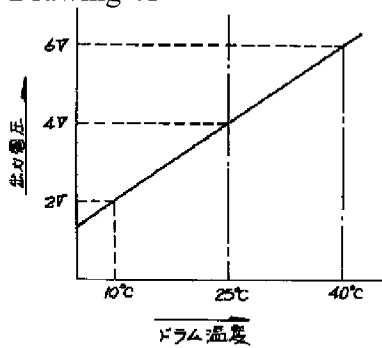
Drawing 39



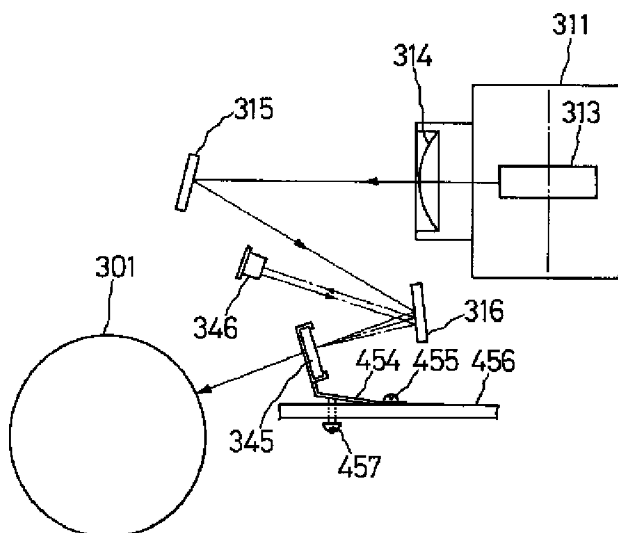
Drawing 40



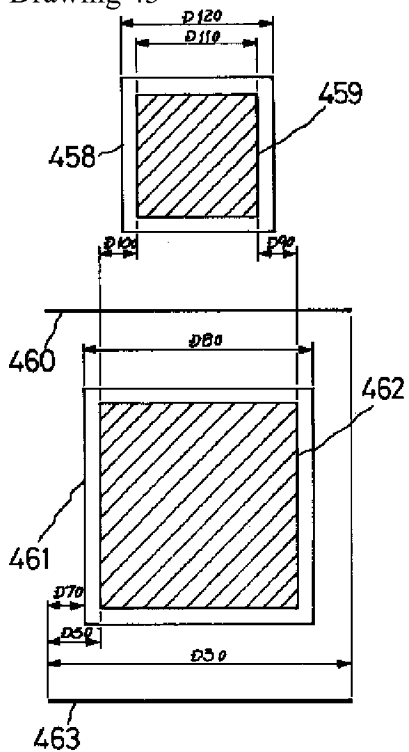
Drawing 41



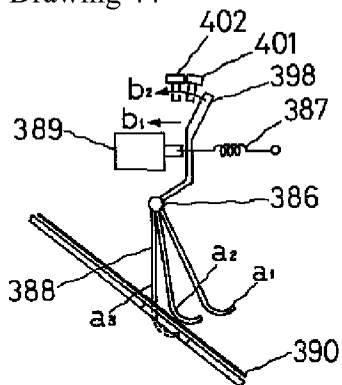
Drawing 42



Drawing 43



Drawing 44



Drawing 45  
(A)

アドレス	内 容	
4000 4001	A 3	トップマージンテーブル (5mm)
4002 4003		ボトム (5mm)
4004 4005		レフト
4006 4007		ライト
4008 4009		トップマージンテーブル (5mm)
400A 400B	B 4	ボトム (5mm)
400C 400D		レフト
400E 400F		ライト
4010		
}		
4080 4081	A 6	トップマージンテーブル (5mm)
4082 4083		ボトム (5mm)
4084 4085		レフト
4086 4087		ライト
4100		
}	トップ/ボトム マージン変更 テーブル	10 mm
		15 mm
		20 mm
	トップマージン 調整テーブル	スイッチ 1
		}
		スイッチ n
	カセット上/下 調整テーブル	スイッチ 1
		}
		スイッチ n
	カセット/手差し 調整テーブル	スイッチ 1
		}
		スイッチ n
4200	ドラム特性テーブル	
}	A	
42FF	B	
}	C	
4300	交換テーブル (ドラム)	
}	"	
43FF	(現像機)	
}	"	
4400	(実装ローフ)	
}		
47FF	制御用タイマーテーブル	

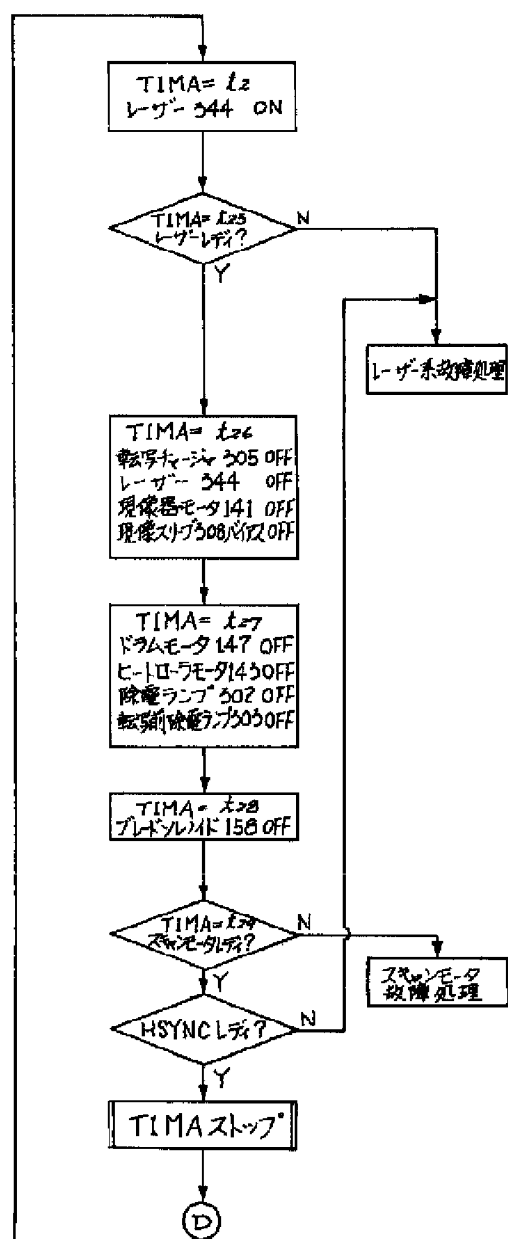
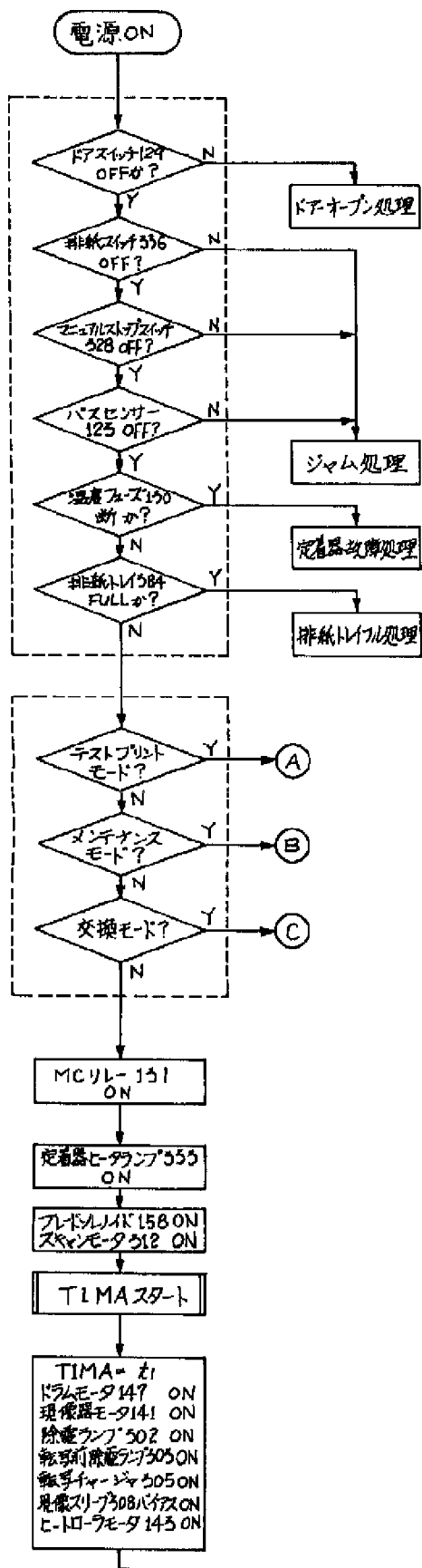
(B)

アドレス	内 容
6000	ドラム特性 A0
6100	ジヤム 必至
6200	排紙トレイカウンター
6300	ドラム交換 カウンター
6400	現像剤交換 カウンター
6500	実装ローフ交換 カウンター

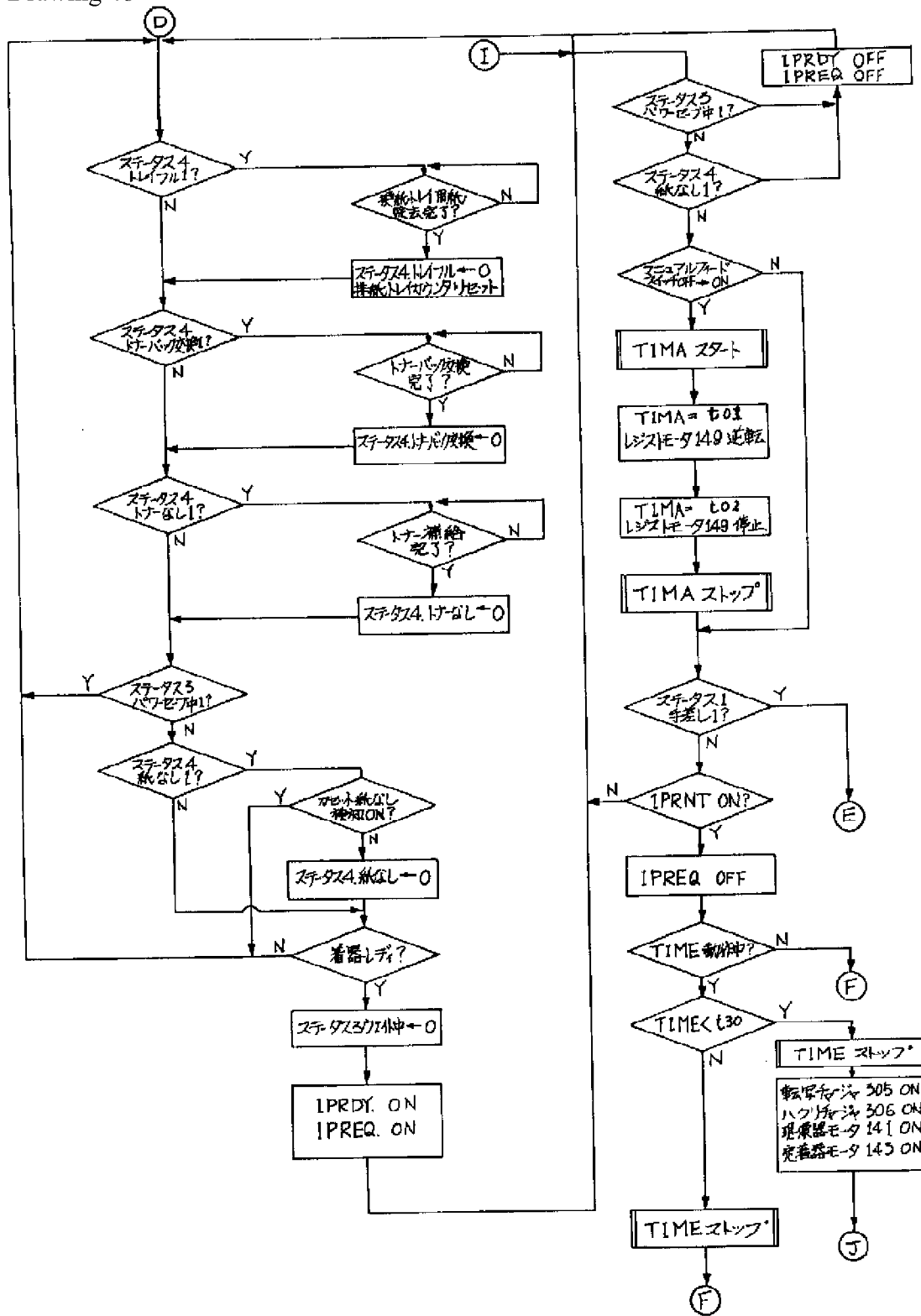
Drawing 46

TIM A
TIM B
}
TIM E
紙サイズレジスタ
ステータス 1
ステータス 2
}
ステータス 6
その他

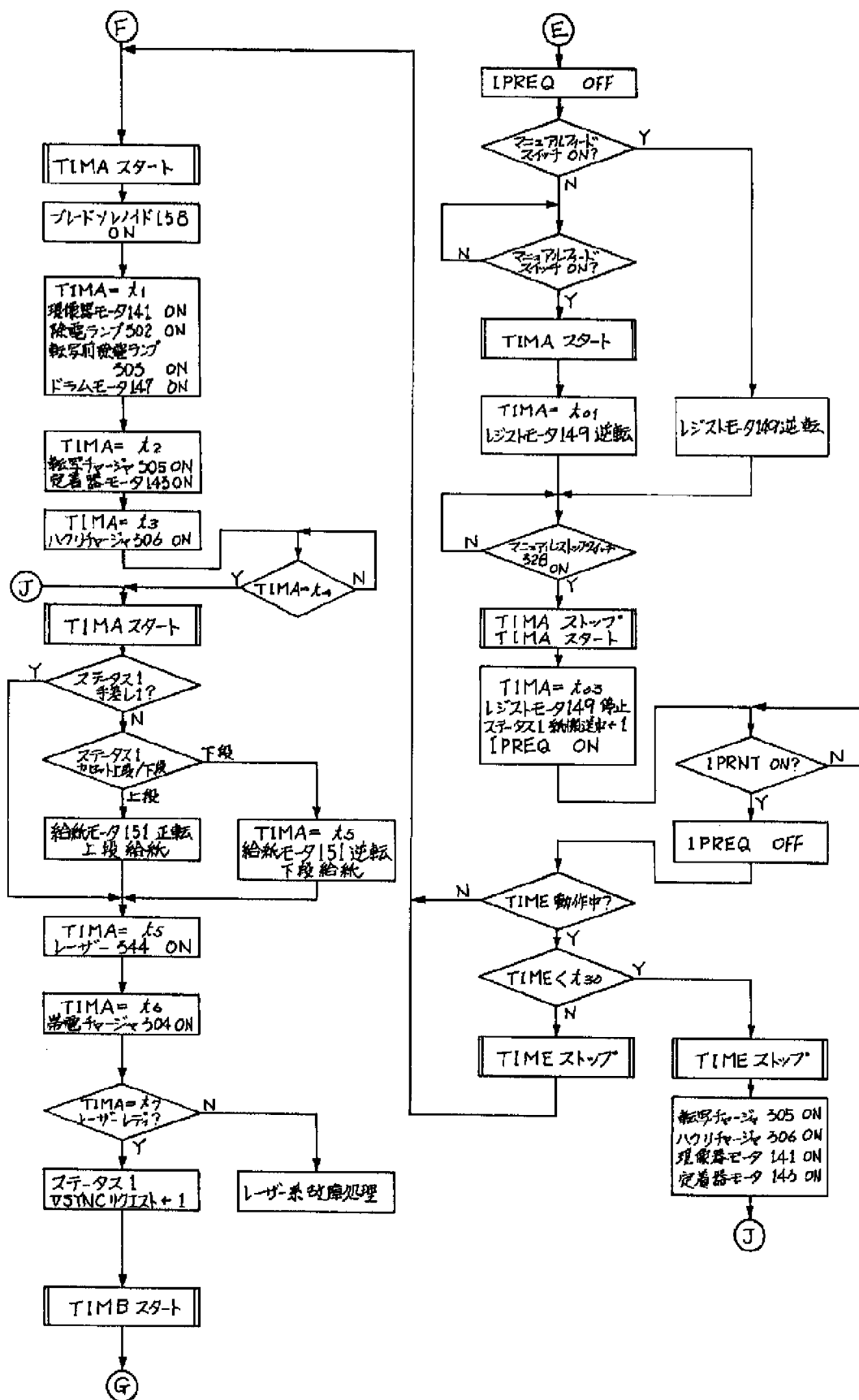
Drawing 47



Drawing 48

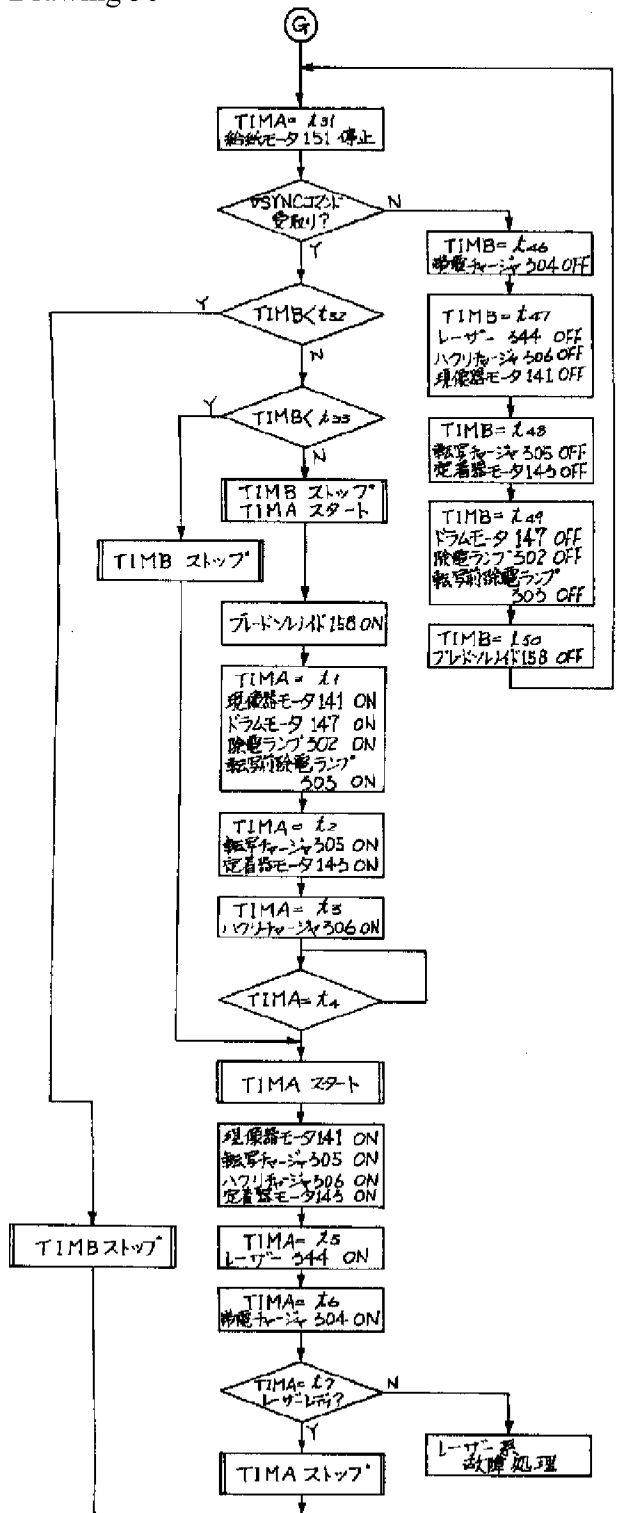


Drawing 49



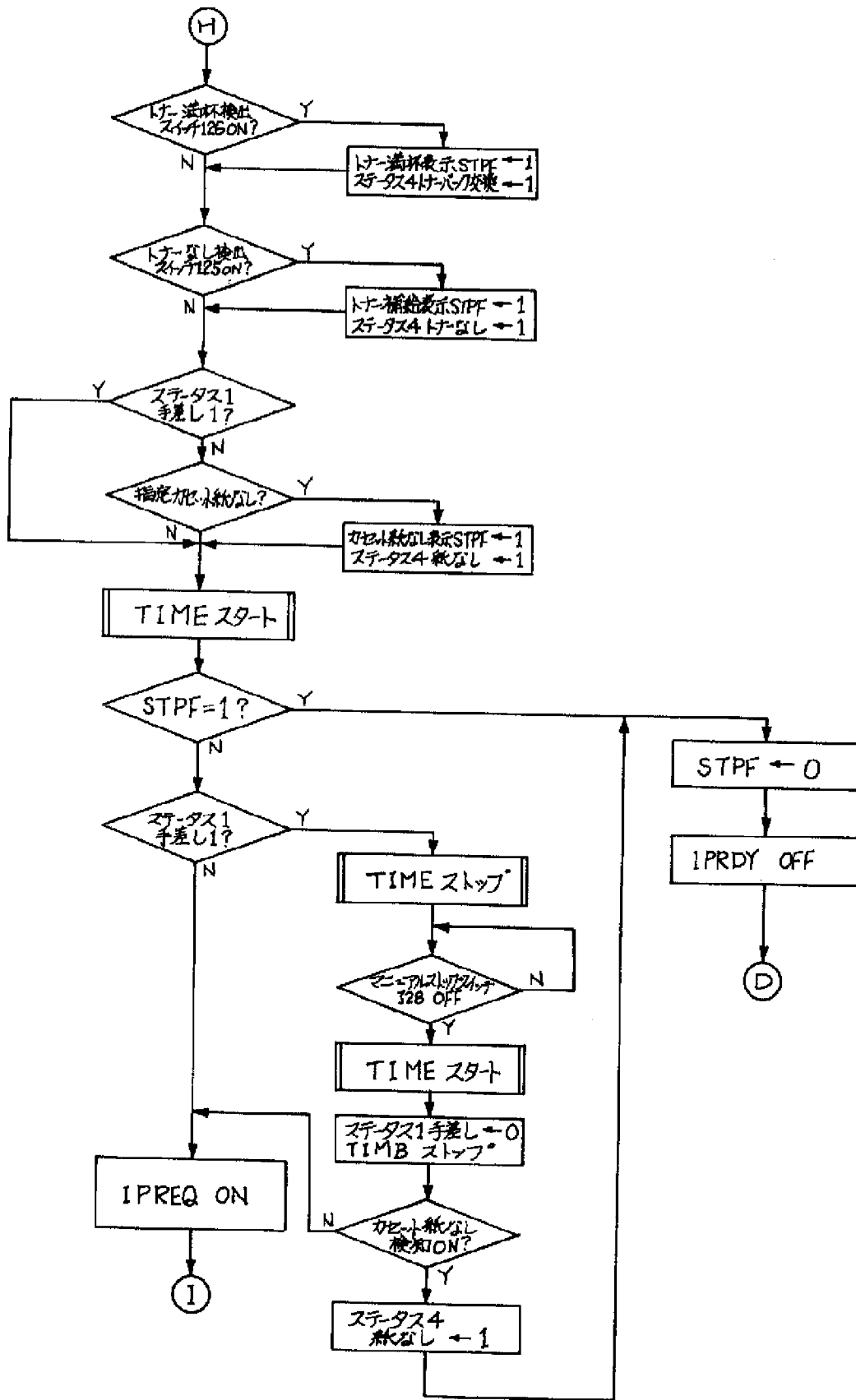


Drawing 51

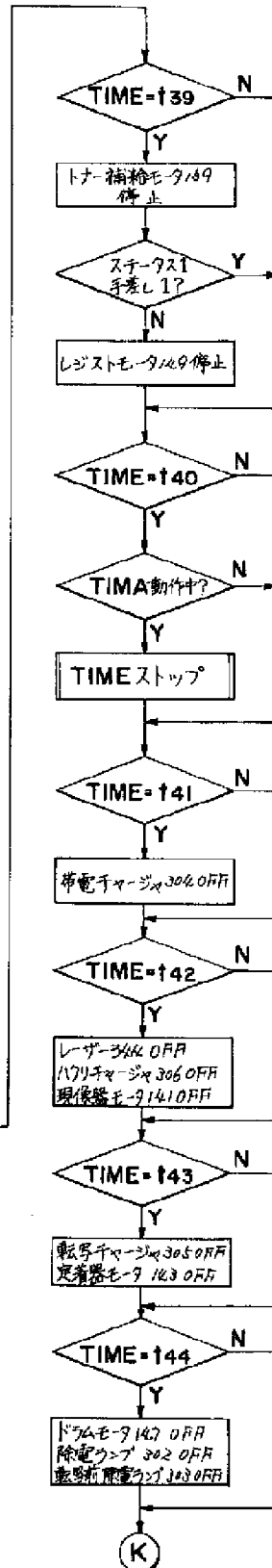
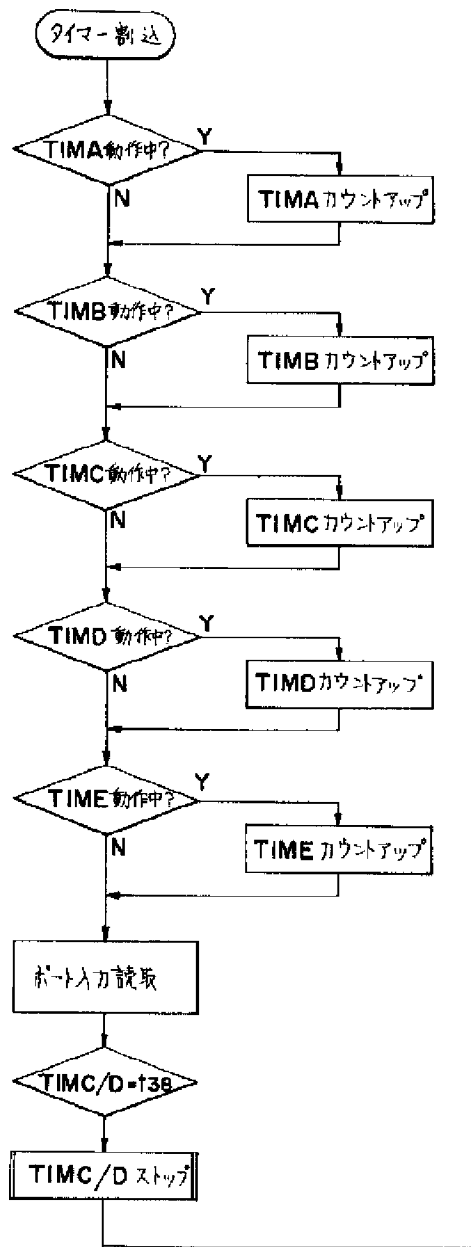


```

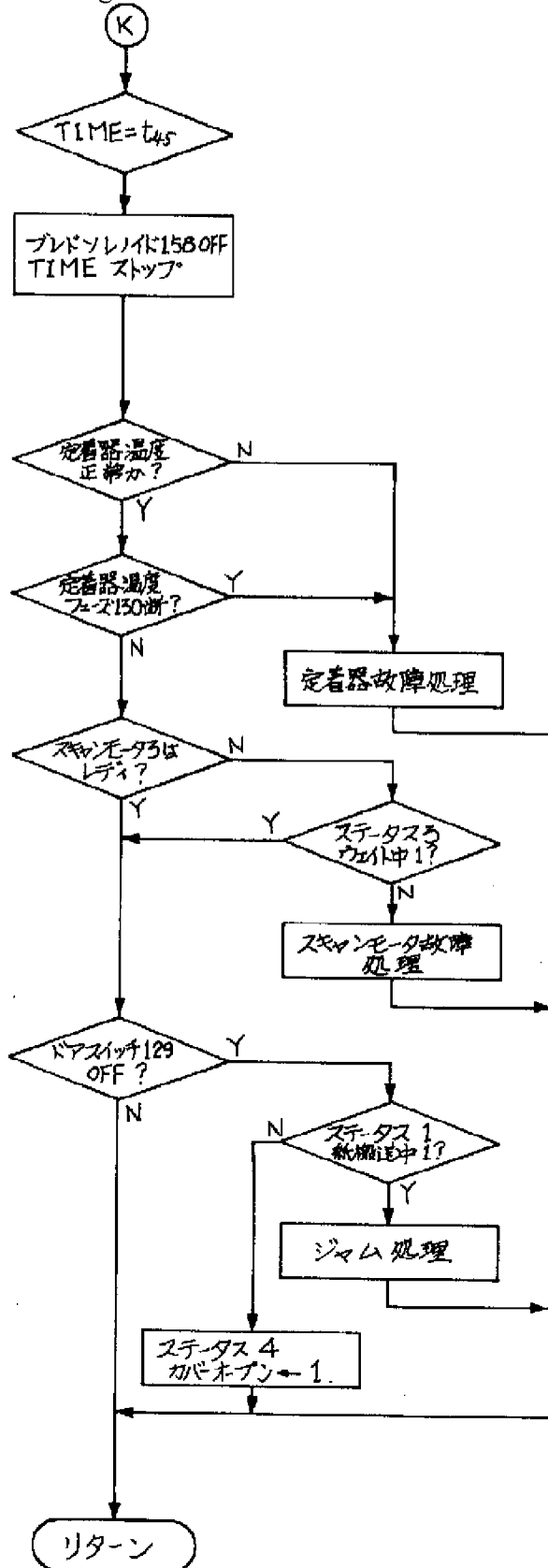
graph TD
    Start(( )) --> Step1[ペジントレジスタカウンタカウンタ増進、直線書込]
    Step1 --> Step2[TIMCスタート  
TIMDスタート]
    Step2 --> Step3[TIMA = 134  
TIMA ストップ  
連続モタ151停止]
    Step3 --> Step4[TIMC/D = 135  
レジモタ149正転  
トラカウンタ553 ON]
    Step4 --> Step5{TIMC/D = 134  
に達したか?}
    Step5 -- (高) --> Step6[トラ補給モタ159 ON]
    Step5 -- (低) --> Step7{ペジント到達か?}
    Step7 -- Y --> Step8[直線書込終了  
TPENDパルス出力]
    Step7 -- N --> Step9{TIMC/D = 107}
    Step9 -- Y --> Step10[レーザー系  
故障処理]
    Step9 -- N --> Step11{トレイフル?}
    Step11 -- Y --> Step12[トレイフル表示、STPF ← 1  
ステータストレイフル ← 1]
    Step11 -- N --> Step13{ドラム交換?}
    Step13 -- Y --> Step14[数字表示器C、表示  
ステータスドラム交換 ← 1]
    Step13 -- N --> Step15{現像剤交換?}
    Step15 -- Y --> Step16[数字表示器C、表示  
ステータス現像剤交換 ← 1]
    Step15 -- N --> Step17{ヒートロー交換?}
    Step17 -- Y --> Step18[数字表示器C、表示  
ステータスヒートロー交換 ← 1]
    Step17 -- N --> End((H))
  
```



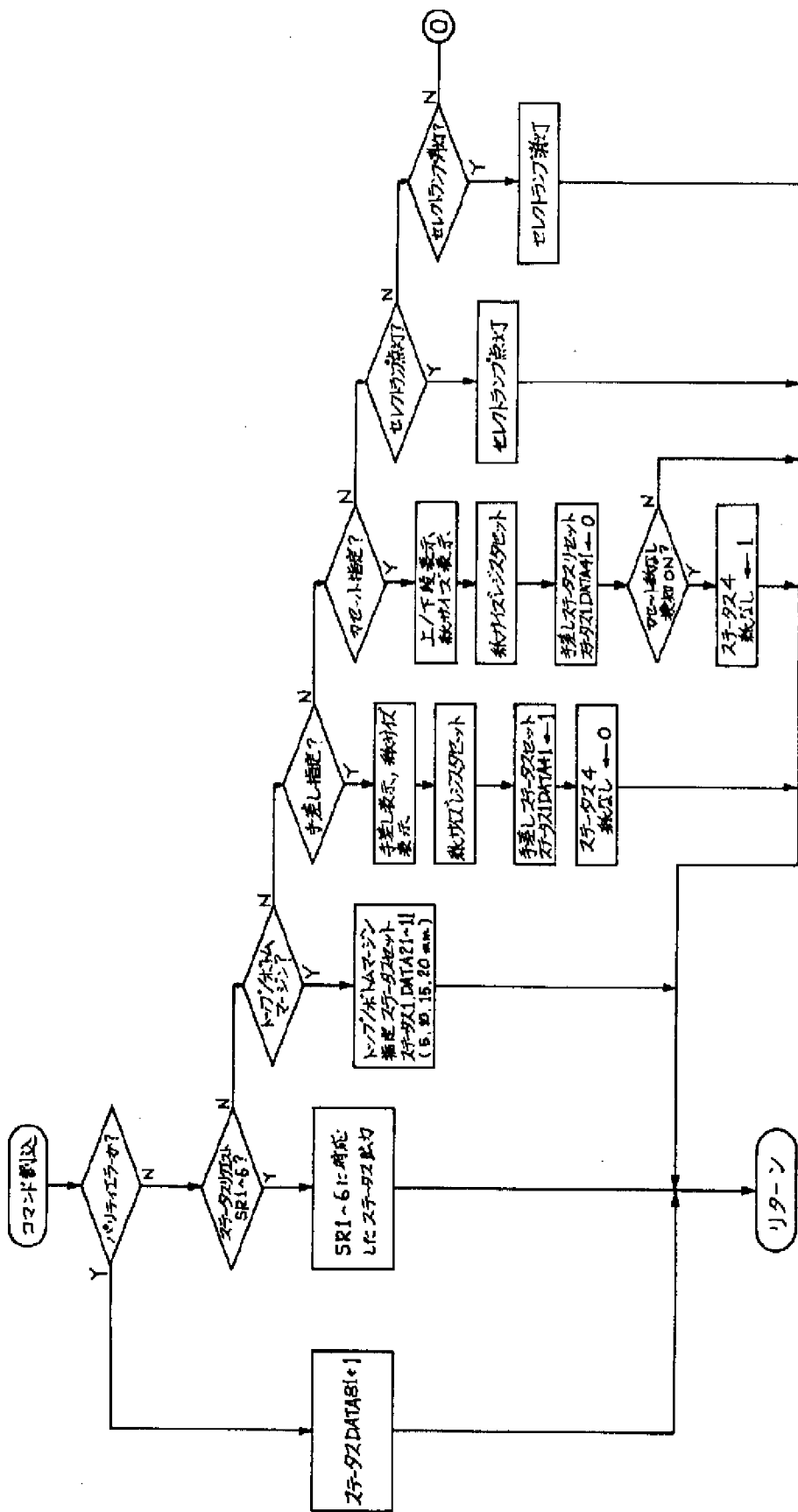
Drawing 52

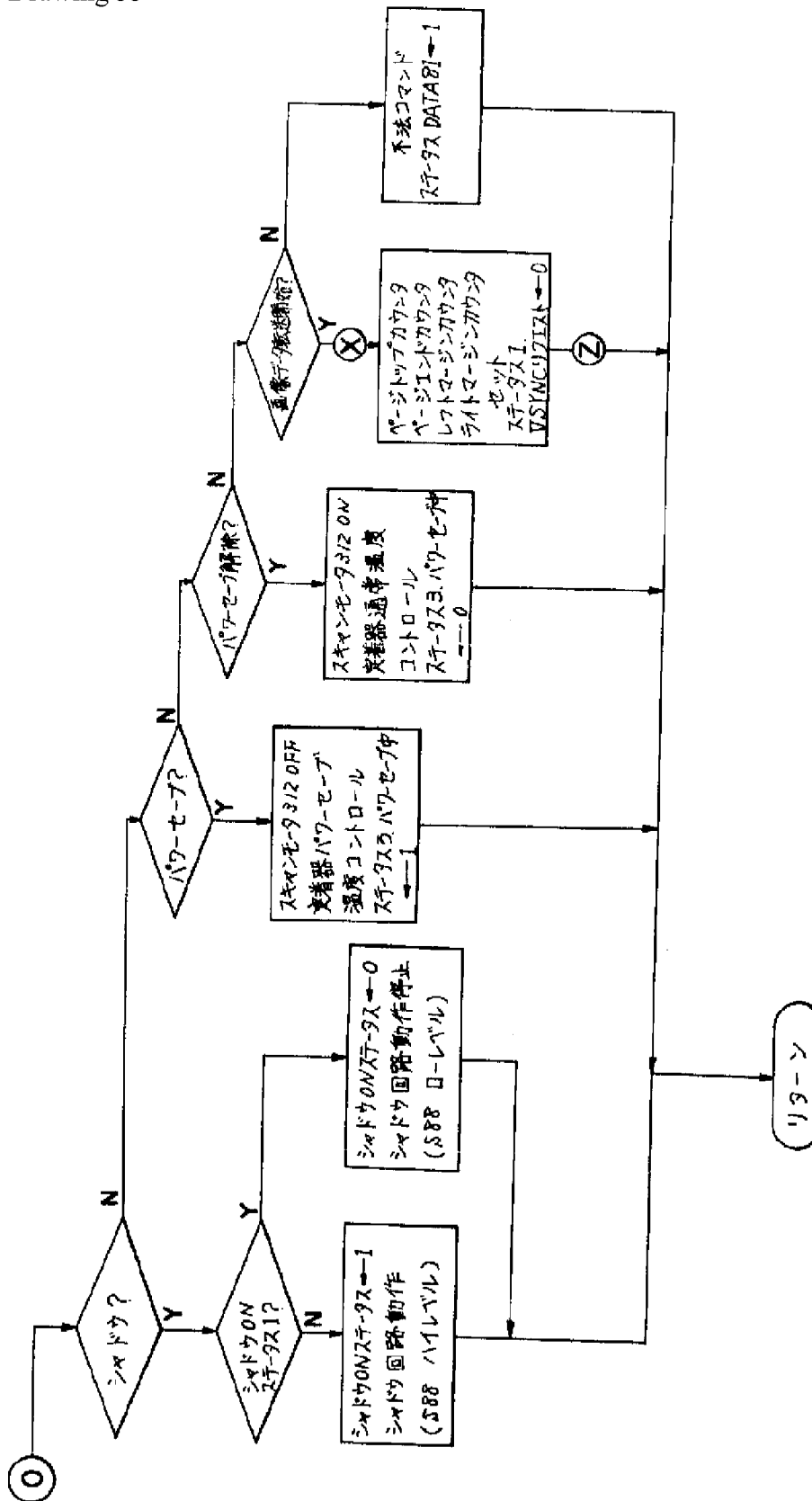


Drawing 53



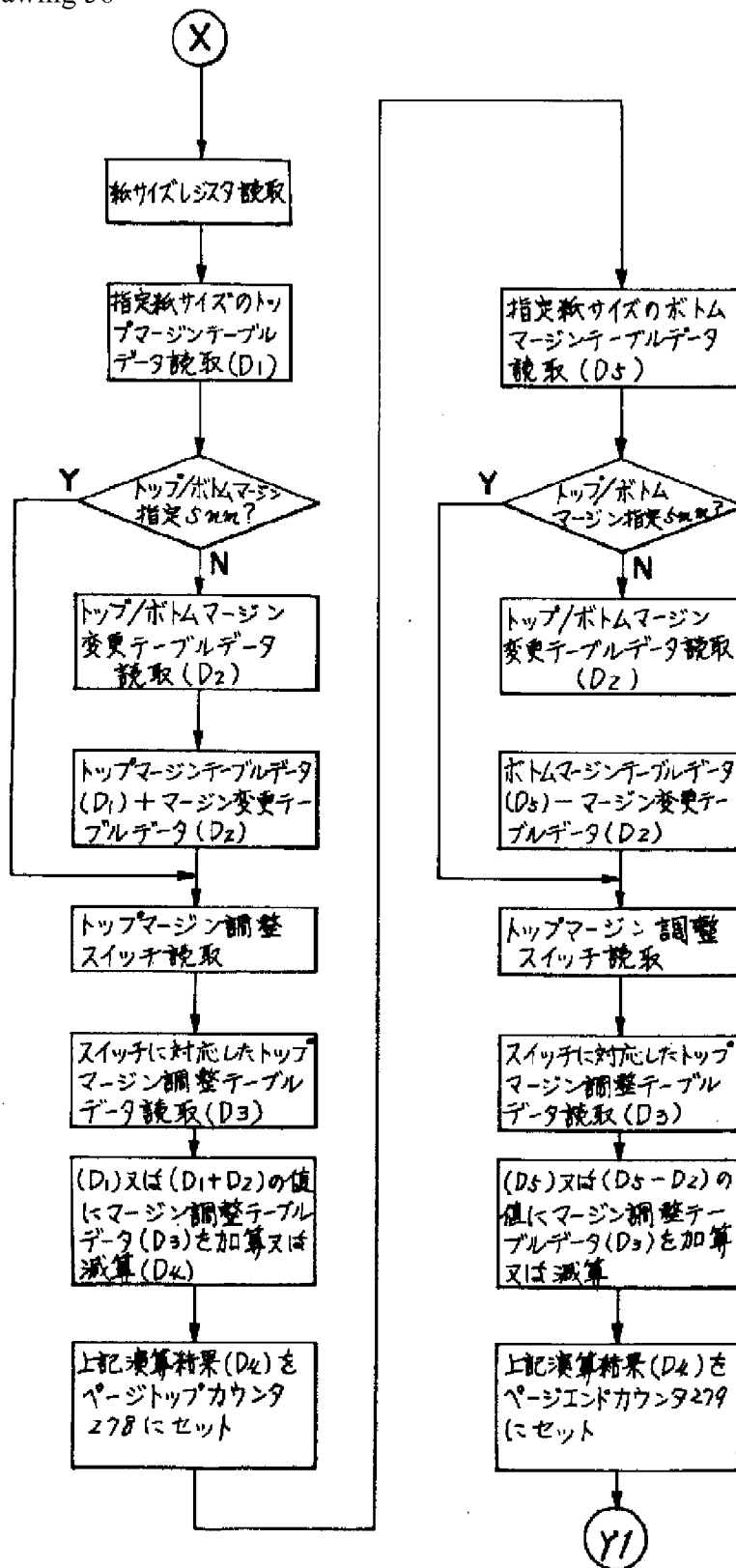
Drawing 54



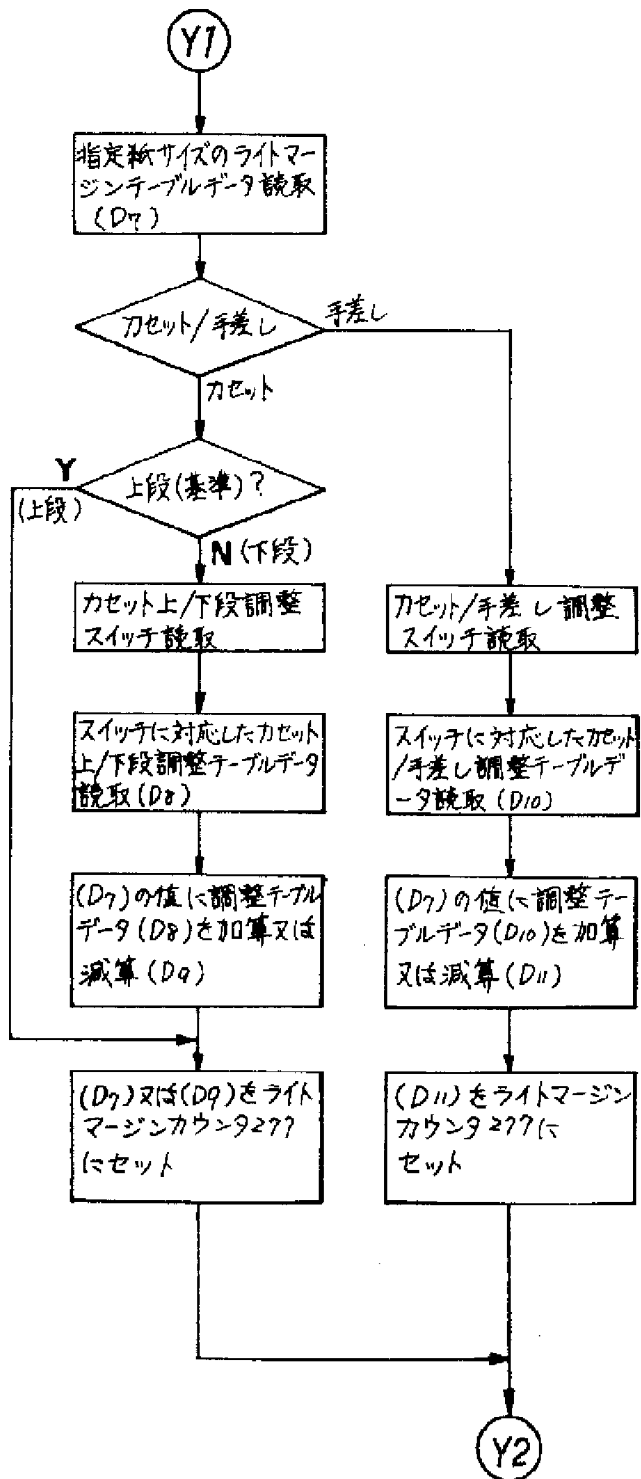




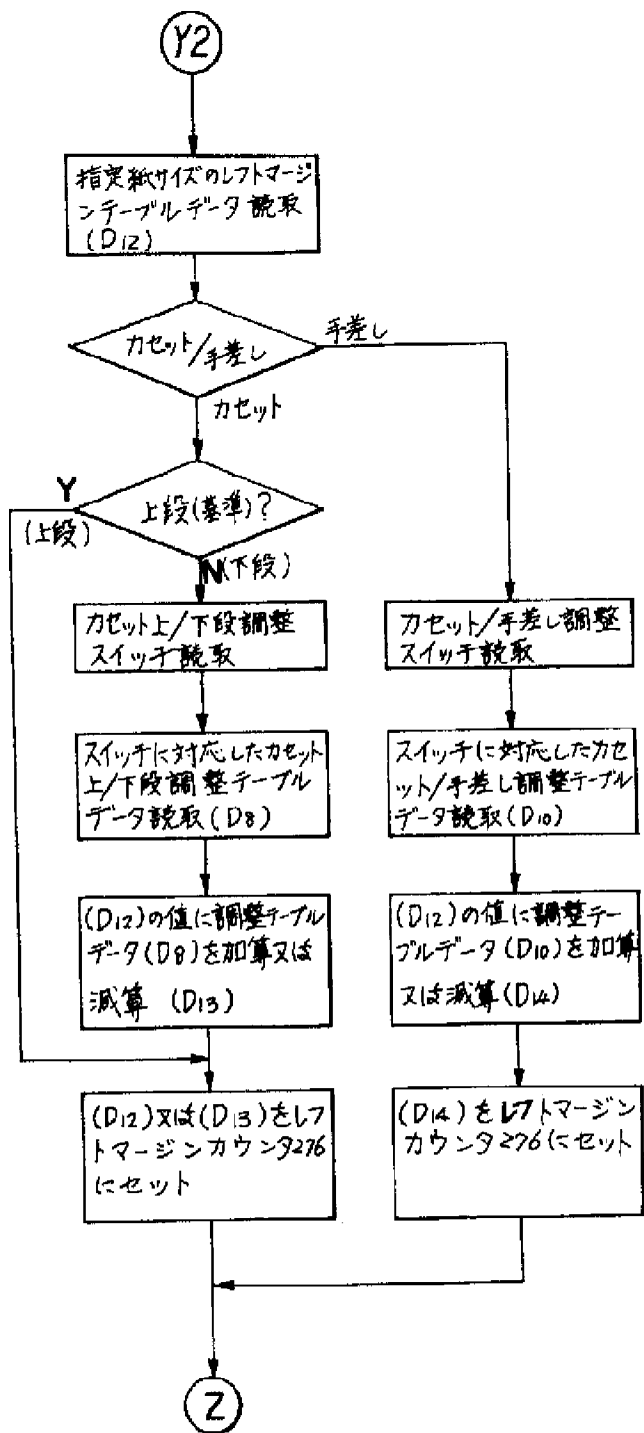
Drawing 56



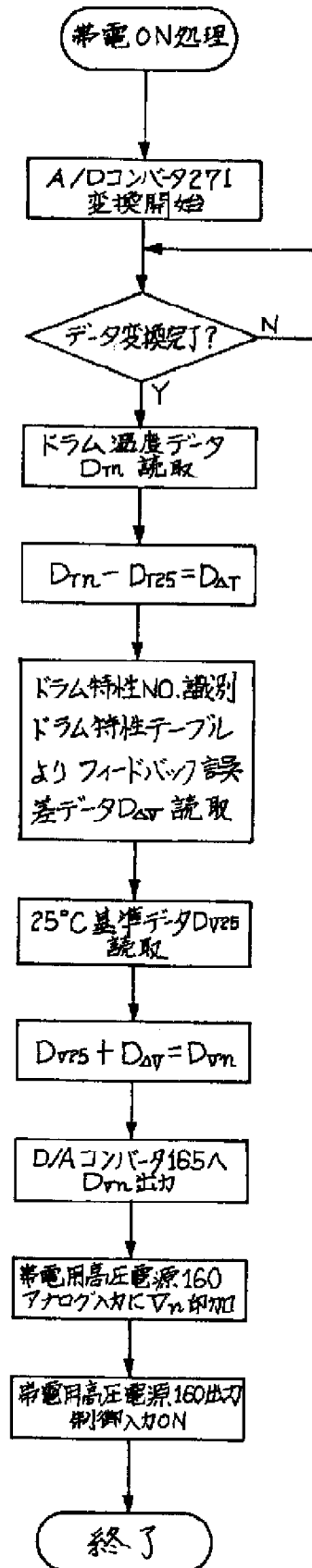
Drawing 57



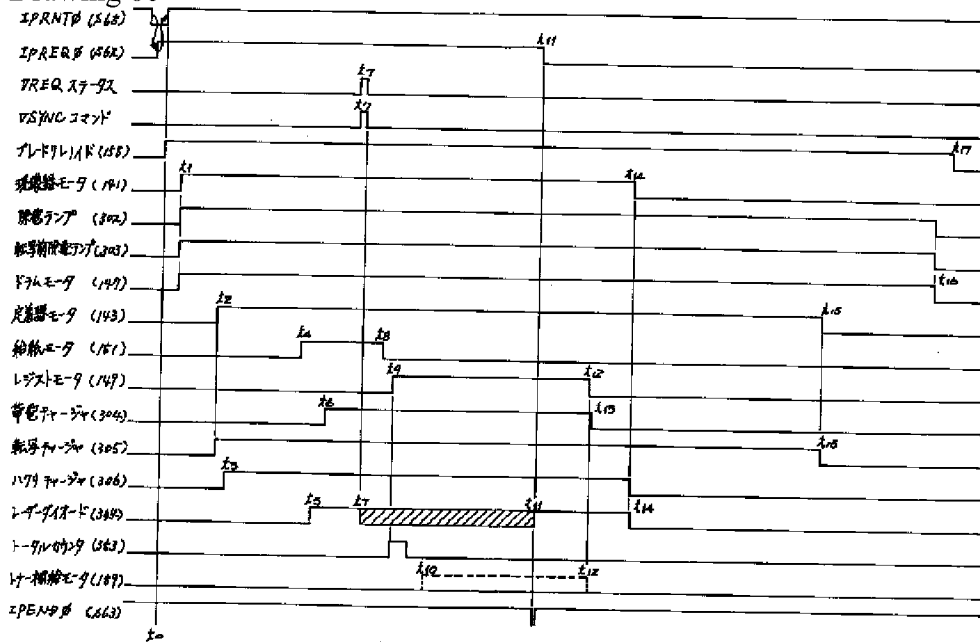
Drawing 58



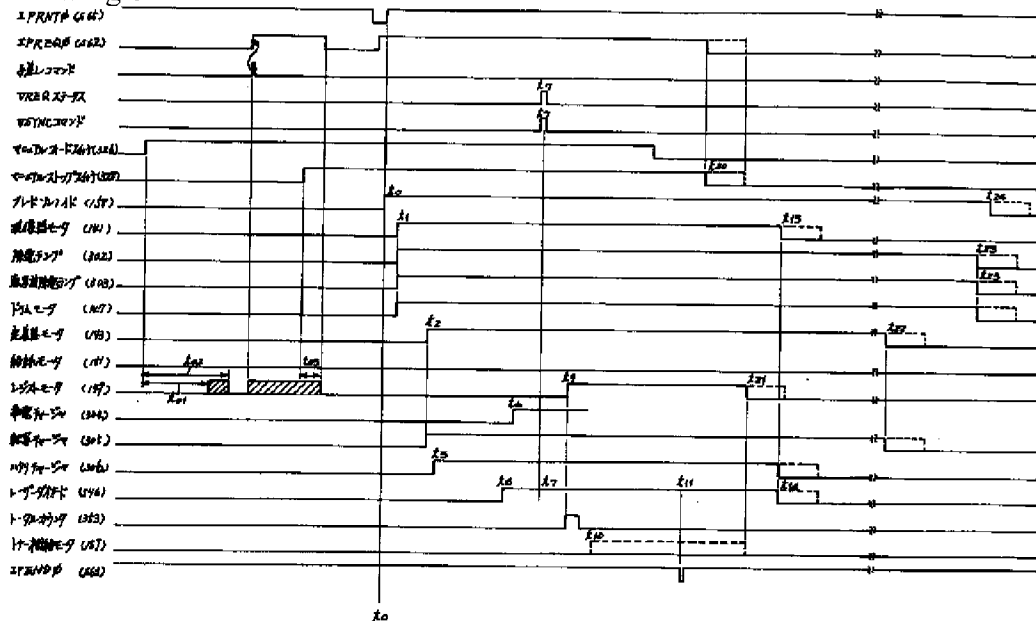
Drawing 59



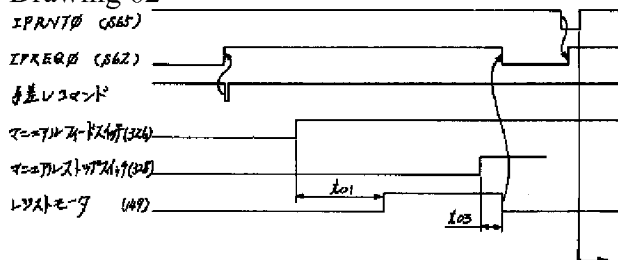
Drawing 60



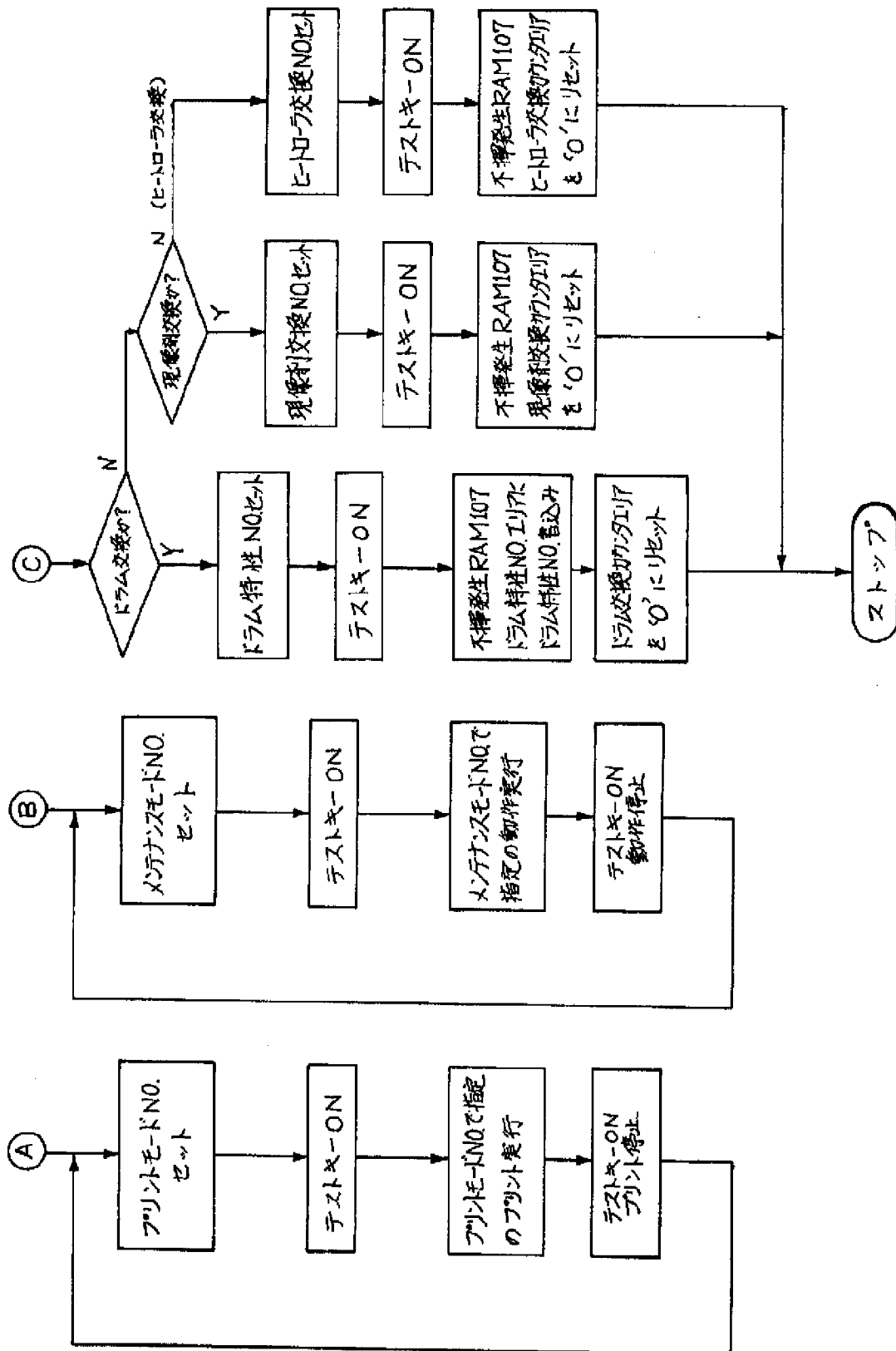
Drawing 61



Drawing 62



Drawing 63



Drawing 64

表 示	エ ラ ー 内 容
ブランク	サービスマンコールなし
1	レーザ故障
2	HSYNC検出故障
3	スキャンモータ故障
4	定着器故障
5	データ転送エラー
6	ドラム交換
7	ヒートローラ交換
8	現像剤交換

Drawing 65

表 示	メンテナンステキスト内容
0	コンパネ表示全ON
1	オートナー調整
2	トナー補給
3	スキャンモータ レーザ ドラムモータ
4	除電ランプ 転写前除電ランプ
5	レジストモータ
6	給紙モータ
7	帯電チャージ
8	転写チャージ 現像バイアス
9	ハフリチャージ
A	紙なしフリント動作

Drawing 66

表 示	交換モードNO.内容
0	空
1	ドラム特性 (A)
2	ドラム特性 (B)
3	ドラム特性 (C)
4	ドラム特性 (D)
5	ドラム特性 (E)
6	ヒートローラ交換
7	現像剤交換

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1 0 3 B 9186-5C

B 4 1 J 3/ 00

D

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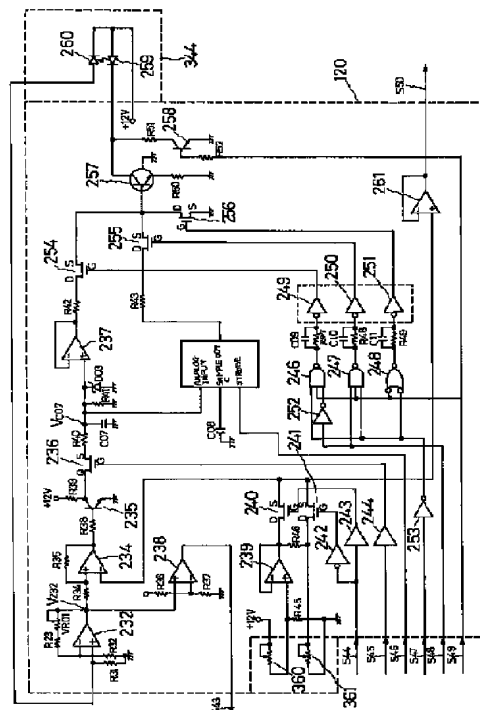
(74)代理人 弁理士 三澤 正義

(54)【発明の名称】 レーザー制御装置

(57)【要約】

【目的】 本発明は、半導体レーザーの光出力の安定化を図ったレーザー制御装置を提供する。

【構成】 本発明のレーザー制御装置は、半導体レーザーの光出力を検出する光検出手段と、前記光検出手段の出力電流を電圧に変換する電流-電圧変換手段と、前記電流-電圧変換手段の出力電圧と基準電圧とを比較する比較手段と、前記比較手段の出力に応じて充放電を行う積分手段と、前記積分手段に充電された電圧を電流に変換して半導体レーザーに供給する電圧-電流変換手段とを有するものである。





## 【特許請求の範囲】

【請求項1】 半導体レーザーの出力を検出する光検出手段と、

前記光検出手段の出力電流を電圧に変換する電流-電圧変換手段と、

前記電流-電圧変換手段の出力電圧と基準電圧とを比較する比較手段と、

前記比較手段の出力に応じて充放電を行う積分手段と、

前記積分手段に充電された電圧を電流に変換して半導体レーザーに供給する電圧-電流変換手段とを有することを特徴とするレーザー制御装置。 10

【請求項2】 前記積分手段は、スイッチング手段を有し、

前記半導体レーザーの光量安定化動作を行うときは前記スイッチング手段をオン状態とし、

前記レーザーの変調動作を行うときは前記スイッチング手段をオフ状態とすることを特徴とする請求項1記載のレーザー制御装置。

【請求項3】 前記半導体レーザーの光量設定は前記基準電圧を可変することにより行うことを特徴とする請求項1、2記載のレーザー制御装置。 20

【請求項4】 前記電圧-電流変換手段は、半導体レーザーが光発振を起こすしきい値電流以下の電流を前記半導体レーザーに流す電流駆動手段を有し、

前記半導体レーザーの変調を行う際には前記電流駆動手段を常時駆動させることを特徴とする請求項2記載のレーザー制御装置。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】本発明は、半導体レーザーの光出力を安定化させるレーザー制御装置に関する。 30

## 【0002】

【従来の技術】近年、半導体レーザーは種々の分野で応用されてきているが、どの分野においてもレーザー光量を安定化させることは重要な条件となっている。特に、半導体レーザーの光出力を多段階に切り換えて使い分ける際には、この切り換え時の光出力の安定化は重要な問題である。さらに、半導体レーザーは温度依存性が大きいので、わずかの温度変化でも光出力が大幅に変化してしまい、光出力の安定化が一層困難となっている。

【0003】ところで、半導体レーザーは異常電流、異常電圧に対して大変破損し易い性質を有している。従来、レーザー光量の安定化に際して半導体レーザーに異常電流が流れあるいは異常電圧が印加されることがあり、半導体レーザーの破損率が大きかった。また、従来より、半導体レーザーの変調には、変調用トランジスタが用いられている。通常、この変調用トランジスタの変調周波数は4～10MHz程度で行われ、速い応答性が要求される。従って変調用トランジスタは高周波用のもので採用されている。しかし、高周波用のトランジスタ 50

は接合容量との関係でパワー損失が生じてしまい、このパワー損失を補うべく大電流のトランジスタを配置しなければならないという問題があった。

## 【0004】

【発明が解決しようとする課題】本発明は上記事情に鑑みて成されたものであり、半導体レーザーの光出力の安定化にあたって精度の向上を図ると共に、安定化に際して異常電流等が流れることなく半導体レーザーの故障率を大幅に低減することができ、またパワー損失を低減し、応答性が良く、微小な光出力の制御も可能なレーザー制御装置を提供することを目的とするものである。

## 【0005】

【課題を解決するための手段】請求項1記載のレーザー制御手段は、半導体レーザーの出力を検出する光検出手段と、前記光検出手段の出力電流を電圧に変換する電流-電圧変換手段と、前記電流-電圧変換手段の出力電圧と基準電圧とを比較する比較手段と、前記比較手段の出力に応じて充放電を行う積分手段と、前記積分手段に充電された電圧を電流に変換して半導体レーザーに供給する電圧-電流変換手段とを有するものである。

【0006】請求項2記載のレーザー制御装置は、前記積分手段は、スイッチング手段を有し、前記半導体レーザーの光量安定化動作を行うときは前記スイッチング手段をON状態とし、前記レーザーの変調動作を行うときは前記スイッチング手段をOFF状態とするものである。

【0007】請求項3記載のレーザー制御装置は、前記半導体レーザーの光量設定は前記基準電圧を可変することにより行うものである。

【0008】請求項4記載のレーザー制御装置は、前記電圧-電流変換手段は、半導体レーザーが光発振を起こすしきい値電流以下の電流を前記半導体レーザーに流す電流駆動手段を有し、前記半導体レーザーの変調を行う際には前記電流駆動手段を常時駆動させるものである。

## 【0009】

【作用】請求項1記載のレーザー制御装置によれば、光検出手段により半導体レーザーの光出力を検出し、この光検出手段の出力電流を電流-電圧変換手段により電圧に変換して比較手段の基準電圧と比較した後、その比較結果に応じて積分手段により充放電を行い、さらに電圧-電流変換手段により積分手段の充電電圧を電流に変換して半導体レーザーに供給するようにしたものである。

【0010】従って、半導体レーザーの光出力が一定になるように制御されることになり、温度変動に拘らず極めて精度の高い光出力の安定化が図れる。特に、比較手段はシステリシス特性を有しているため、比較判断の安定化が向上し光出力の安定化の精度向上に寄与できる。

【0011】また、半導体レーザーがオンされているときには、積分手段の働きによりかなり遅い時間で徐々に電流を上昇させてゆくの、半導体レーザーに異常電流

が流れることはなく、半導体レーザーの故障率が大幅に低減される。

【0012】さらに、光出力設定基準電圧と半導体レーザーの光出力が比例関係にあるため、正確な光出力設定ができる。

【0013】請求項2記載のレーザー制御装置によれば、積分手段に設けたスイッチング手段を、半導体レーザーの光量安定化動作の際にオンとし、変調動作の際にオフ状態とするので、半導体レーザーの光出力の安定化を確実に行うことができる。

【0014】請求項3記載のレーザー制御装置によれば、半導体レーザーの光量設定を、基準電圧を可変することにより行うので、基準電圧を変えることで微小な光出力の制御を行うことができる。

【0015】請求項4記載のレーザー制御装置によれば、半導体レーザーの変調を行う際電流駆動手段の動作により、光発振を起こすしきい値電流以下の電流を半導体レーザーに供給するので、小電力の電流駆動手段を用いてパワー損失を伴うことなく応答性が良好な状態で半導体レーザーを制御できる。

【0016】

【実施例】以下、本発明を適用した図示の一実施例を参照しながら説明する。

【0017】図1は、レーザービームによって、記録媒体上に情報を記録するためのシステムのブロック図である。情報を供出するホスト側システム1（電子計算機、ワードプロセッサ本体等）よりの情報は、データ制御部2に与えられる。データ制御部2では、ホスト側システム1より与えられた情報をドット対応のデータに変換し、ページメモリに記憶する。

【0018】この記憶したドットイメージのデータを印字制御部100に送出する。

【0019】印字制御部100では、入力されたドットイメージデータを、レーザービームを変調することによって、記録媒体上に書き込みそれを現像転写し、記録用紙上に前記ドットイメージデータを印字する。

【0020】図2は、ビデオインターフェイスを持った、プリンタ300の機構詳細図を示すものでプリンタ300は図2の印字制御部100を内蔵する。

【0021】図2に於いて、300は、プリンタ本体、301は、レーザービームによって情報を記録するための像担持体としての感光体、302は前記感光体301の電荷を初期状態に除電するための除電ランプで複数の赤色LEDで構成されている。303は転写効率を上げるための除電ランプで、前記除電ランプ302と同様、複数の赤色LEDで構成されている。304は前記感光体301を一様に所定の電位に帯電させるための帯電チャージャ、305は前記感光体301上に現像されたトナーを用紙に転写させるための転写チャージャ、306は転写後の用紙を前記感光体より分離させるための剥離

チャージャである。

【0022】307は、前記感光体301上に、レーザービームによって書込まれた静電潜像を現像させるための現像器、308は前記現像器307の構成要素であり、前記トナーを前記感光体301上の静電潜像に付着させるためのマグネットローラであり、矢印の方向に回転する。

【0023】309は前記マグネットローラの現像剤と接触し、現像剤のトナー比濃度を測定するためのオートトナープローブ、310は転写後、前記感光体301上に残存するトナーを除去するためのクリーニングブレードである。

【0024】311はデータ制御部より入力されるビデオデータを、前記感光体301上にレーザービームを走査、変調して記録するためのレーザースキャヌユニット、312はレーザーダイオードよりのレーザービームを前記感光体301上に導くための8面体のポリゴンミラー、313は前記ポリゴンミラー312を高速で回転させるための、スキャンモータ、314は前記感光体301上でのレーザービームの走査速度を一定にするための $f \cdot \theta$ レンズである。315及び316は前記スキャヌユニット311よりのレーザービームを前記感光体301に導くための反射ミラーである。

【0025】317は500枚の用紙が収納できる上段側カセット、318は前記上段カセット317より用紙を1枚ずつ取出すための上段給紙ローラ、319は前記上段カセット317に用紙がなくなったことを検出する上段紙なしスイッチ、320は前記上段カセット317に設けてある、サイズ識別用のマークを検出する4ビットで構成された上段カセットサイズ検出スイッチである。321は下段給紙ローラ、323は下段紙なしスイッチ、324は下段カセットサイズ検出スイッチをそれぞれ示す。また上段側には、下段側の250枚収納できる、カセットをも使用可能な構造になっている。

【0026】326は手差しガイド325より挿入された用紙を検出するマニュアルフィードスイッチ、327は前記マニュアルフィードスイッチ326によって挿入が確認された後その用紙を搬送するための手差し用給紙ローラ、328は前記手差し給紙ローラ327によって搬送されてきた用紙を検出する、マニュアルストップスイッチである。

【0027】329は前記感光体301上に現像された画像と用紙との同期をとらせるためのレジストローラ、330は前記剥離チャージャ306によって分離された用紙を定着器まで搬送するための搬送ベルト、331は転写された用紙上のトナーを定着させるための定着器、332は定着用ローラ、333は前記定着ローラを加熱するためのヒータランプ、334は前記定着ローラの表面温度を検出するためのサーミスタ、335は排紙ローラ、336は前記定着器331より排出された用紙を検

出するための排紙スイッチである。

【0028】337はプリンタ300内を冷却するための冷却ファン、338は前記帯電チャージャ304、転写チャージャ305、剥離チャージャ306及び前記現像器、マグネットローラ308にそれぞれ印加する高圧電圧を発生させる高圧トランス、339はそれぞれの制御に使用されるDC電圧を発生する電源装置、340はプリンタ300を制御するPC板ユニットである。

【0029】342は感光体301の近くに設けられた感光体301の温度を検出するためのドラム温度センサで、熱抵抗の非常に小さいサーミスタが使用されている。

【0030】図3はレーザービームによる前記感光体301への情報記録を行うための部分の概要を示す斜視図である。図3に於いて、半導体レーザー344より出たレーザービームは、コリメータレンズ343によって平行光に補正され、その平行光が、ポリゴンミラー313の8面体のある1面に当てられる。ポリゴンミラー313は、スキャンモータ312によって、矢印方向に高速回転しているので、前記ポリゴンミラーに入射したレーザービームは、 $f \cdot \theta$ レンズ314を通して、ビーム走査範囲348の範囲を、左から右方向に走査される。ビーム走査範囲348内の一部のレーザービームは、反射ミラー345によって、ビーム検出器346に導かれる。従って、前記ポリゴンミラー313の1面による1回の水平走査毎に前記ビーム検出器346は、走査されているレーザービームを検出する。またビーム走査範囲348内の反射ミラー345に入射されないレーザービームは、前記感光体301に照射される。図3中感光体301上のレーザービームが走査される所を349に示す。304は帯電チャージャ、347は用紙をそれぞれ示す。尚、図2に示すように実際のプリンタは $f \cdot \theta$ レンズ314を通過したレーザービームが直接感光体301に照射されるのではなく、反射ミラー315及び316によって反射されることによって感光体301に導かれるが、図3においては便宜上反射ミラー315及び316を図示せず。 $f \cdot \theta$ レンズ314を通過したレーザービームが直接感光体301に照射されるが如くに示してある。

【0031】ここで、前記反射ミラー345の構成について図42を参照して説明する。同図に示すようにこの反射ミラー345はビーム入射領域外に位置する支持部材456上に板バネ454を介してビス455によって取り付けられており、この板バネ454の下部には微調整ネジ457が設けられており反射ミラー345の角度を変更できるようになっている。

【0032】図3及び図42に示したところのレーザーシステムユニットは図2に示すところからも明らかなように外部から遮断され、走査ビームが漏れないようにされている。そして、ビーム検出器346によるビーム検

出の検出結果は図6に示す走査パネルの適宜な位置において表示されるようになっている。

【0033】図4はレジストローラ前パスセンサー394の説明図である。図2に於けるマニュアルストップスイッチ328は、手差し用紙の検出のみ行うのに対し、カセット給紙時の用紙の検出を行うのがレジストローラ前パスセンサー394の目的である。図4に於いて、上段カセット317及び下段カセット321より上段給紙ローラ318、下段給紙ローラ322のどちらか一方により給紙された用紙は、用紙ガイド板に沿ってレジストローラ329まで給紙される。このとき、給紙が正しく実行されれば発光ダイオード393より出た光は、用紙によって遮断され前記レジストローラ前パスセンサー394に光が入らないことによって給紙された用紙を確認できる。また給紙が正しく行えなかった場合、用紙が、前記レジストローラ前パスセンサーの位置まで到達しないため、前記レジストローラ前パスセンサーには、前記発光ダイオード393よりの光が入射され続けているために、用紙が給紙されなかったことを認識できる。

【0034】図5は、オプションユニットである反転トレイ381の概要図である。通常プリンタ300には、図2に示した様に非反転形のトレイ397が取り付けられている。この様な非反転形を使用した場合最初の印字用紙は、一番下側になってしまうため、情報供出装置（ホストシステム1）より、最後の頁からデータを送出しなければならないため、ホストシステム1での情報のファイル方法が複雑になってしまう欠点がある。従って、前記欠点を補うためには、本反転トレイ381が必要不可欠である。

【0035】図5に於いてプリンター300の排紙ローラ335を通過した用紙は、搬送ローラ382、383によって、トレイ384に前記排紙ローラ335を通過したときとは反転した形で収納される。従って、用紙の印字面は下側になっているので、最初の頁は一番下側であるが、トレイ384より用紙を取出し、用紙の印字面を表側にすると、最初の頁は上側に最後の頁は下側になり前述の非反転形トレイ397の欠点は解決できる。尚、同図において、385は、用紙ストッパーで、印字用紙の搬送方向の長さに応じてスライドさせることができる。388はトレイに収納された用紙の浮上りを防ぐための用紙押えアクチュエータ、395はトレイ384に正常に用紙が収納されたことを確認するための排紙スイッチ、391はトレイ384内の用紙の有無を確認するための発光ダイオード、392は受光側のトレイセンサーである。用紙390がトレイ384内にある場合、トレイセンサー392には、光が当たらず、用紙390がない場合トレイセンサー392に光が当たることにより用紙390の有無を検出することができる。

【0036】用紙有無及び用紙満杯の検出部の他例を図44に示す。これは回動支点386を中心としてアクチ

エータ388を設けると共に上方にレバー398を連結しておき、レバー398の先端を離隔手段たるソレノイド389及び解除手段たるコイル387でいずれか一方に付勢しておき、紙収納部390に紙が収納される状態によってレバー398を移動させ、このときの状態を検知手段例えば複数のセンサー401、402によって検知するようにしている。アクチュエータ388の各種状態においてa1の位置が「紙満杯」、a2の位置が「紙あり」、a3の位置が「紙なし」の状態になる。前記離隔手段389は、少なくとも用紙390が排紙トレイ384内に排出移動される間はアクチュエータ388を離隔し、用紙を検出すべき時例えば印字動作中又は停止中にはそのときの状態信号に同期してソレノイド389がオフになり、アクチュエータ388の離隔を解除するようになり、検知動作が行われる。このため、用紙390の排出先端がアクチュエータ388に衝突することなく、排出動作に支障が生ずることがない。

【0037】尚、排紙トレイ内に送られてくる用紙は1枚毎に排紙スイッチ395によって検出され、この内容が後述する排紙メモリカウンタ(図3のRAM107)によってカウントされ枚数が検出される。そして、「紙満杯」になると図6のトレイフルランプ358に表示されると共に、前記メモリカウンタがクリアされるようになっている。

【0038】図6は、プリンタ300の操作パネルの詳細図である。

【0039】図6に於いて、350はプリンタ300のトップカバー、351は、フロントカバー、352は、メンテナンスカバーとなっており、前記フロントカバー351は、紙ジャム、トナー補給等が生じた場合矢印方向に開けて処理を行う。また、前記メンテナンスカバー352は、上部に開ける構造になっているが、前記フロントカバー351を矢印方向に開いた状態でないと開けられない構造になっていて、オペレータの誤操作を防ぐようになっている。

【0040】353は6桁のメカニカルカウンタで、1枚の用紙への印字毎にプラス1される。354はオンライン/オフラインのセレクトを行うセレクトスイッチ、355は前記セレクトスイッチ354に対応し、オンライン時に点灯するセレクトランプ、356は1桁のセブ  
ンセグメントLEDでサービスマンコール時のエラー内容、メンテナンスモード時のモード番号等を表示する数字表示器、357はプリンタ300に電源が投入されていることを表示する電源ランプ、358は前記反転形  
トレイユニット381に印字用紙が満杯であることを知らせるトレイフルランプ、359はプリンタの動作状態の詳細を表示するカラーLCD表示器をそれぞれ示す。これまで説明したトータルカウンタ353乃至LCD表示器359は常時操作又は表示されているものである。次に前記メンテナンスカバー352を開けないと操作で

きない部分について説明する。以下の部分はサービスマンのみが操作するものである。

【0041】403はメンテナンスモード及び交換モードの選択用のメンテナンススイッチ、406はメンテナンスモード状態であることを示す表示ランプ、407は交換モード状態であることを示す表示ランプ、404は各モード時に於ける動作モードNOの選択を行う選択スイッチ、408は前記選択スイッチ404による選択動作が可能なことを示す選択ランプ、405はテストプリントモードの選択及び前述のメンテナンス、交換、テストプリントの各モード状態での動作を実行させるためのテストスイッチ、360は後述するメイン露光調整用ボリューム、361はシャドウ露光調整用ボリュームをそれぞれ示す。また前記360、361の両ボリュームは、調整用ドライバを差し込んで廻す様な構造になっており前記メンテナンスカバー352を開いた状態で手では廻すことはできない。

【0042】図7は、前記LCD表示器359の詳細図であり、以下各々の表示セグメントの機能について説明する。

【0043】371、372はプリンタ300の待機、レディ状態等を示すセグメントであり、定着器レディまでの待機時は、371、372共点灯、レディ状態では371のみ点灯、プリント動作時は371、372共消灯する。

【0044】373は給紙部のジャム発生するとき点滅し、その給紙状態を示すセグメントも同時に点滅する。すなわち、手差しモード時は手差し指定365、上段カセットモード時は上段カセット364、下段カセット時は、下段カセット363が点滅する。374は搬送系(レジストローラ329以降)ジャムの場合点滅する。このときも給紙ジャムと同様給紙セグメントも同時に点滅する。375は図2のクリーニングブレード310によって回収したトナーが、トナーバック(図示していない)が満杯の場合点滅する。376は現像器307のトナーホッパー(図示していない)にトナーが無くなった時点滅する。377、378は後述するサービスマンエラーが発生した場合点滅する。379は後述するオペレータコールが発生した場合点滅する。380は選択されているカセットに用紙がない場合点滅する。362は選択されている紙のサイズを表示する。たとえば、上段カセット側が選択されており、A4縦の用紙カセットであればA4-Rが点灯し、手差しモードでA6が選択されていればA6が点灯する。363は下段側カセットが選択されているとき点灯、364は上段側カセットが選択されているとき点灯、365は手差しが選択されているとき点灯する。366はプリンタ300の形状を表わすもので常時点灯、367は感光体301を表わすもので常時点灯、368はプリンタ300の上部形状を表わすもので、搬送部ジャム時以外常時点灯、369は搬送部

ジャム（前記374が点滅時）時前記368を交互に点灯する。370は、用紙の搬送状態を表示する5つのセグメントで、右側から左側へ1つのセグメントが点灯しながら移動する。

【0045】図8は、前記図1に於けるデータ制御部2の概略ブロック図である。データ制御部2では、ホスト側システム1より送出されてきた文字コード情報及び画像情報を、プリンタ300の用紙上の印字エリアに対応した、ドット対応のページメモリ20上にデータ変換後記憶させる。また、その記憶したページメモリ20上のデータ

をプリンタ300に送出し印字動作を行わせる。  
【0046】データ制御部2では、2種類の情報を受付ける様に構成されている。すなわち1つは文字コード情報（JIS8単位コード等）で、この場合には、キャラクタージェネレータ15によって、その文字コードに対応する文字パターンを発生し、文字パターンのドット情報をページメモリ20上に記憶する。他方は画像情報で、この場合には、すでにドット情報の形で入力されてくるので、そのままページメモリ20上に記憶する。以降、図8を参照して、データ制御部2の概要を説明する。

【0047】ホスト側システム1よりの情報は、信号線S01を介してインターフェイス50に送られ、さらに前記情報はデータラッチ3に記憶される。

【0048】インターフェイス50とホストシステム1との信号線S02は、ホスト側システム1より送出される。データのストロブ信号、その他の制御用信号線S03は、データ制御装置からのビジー信号及びステータス信号線である。

【0049】ホスト側システム1より送られてくる情報のフォーマットを図9及び図10に示す。図9のフォーマット例は、文字コード情報の場合のフォーマットで、文字コード情報であることを示す文字識別コード、印字する用紙のサイズを示す紙サイズコードが1ページ分の最初に入っている。以降は、1行目、2行目…n行目の順に文字コードデータが入っており、最後にそのページのデータ終了を示すENDコードが入っている。また1行分の文字コードデータは、文字サイズを示すコード、文字コード、1行のデータの区切を表わすLFコードから成り立っている。

【0050】図10は画像情報の場合のフォーマットで、画像情報を示す画像識別コード、印字する用紙のサイズを示す紙サイズ識別コードが1ページ分のデータの最初に入っている。以降は、1ライン、2ライン…mラインの順に画像データが入っている。また、1ラインのデータは、前記紙サイズ識別データによって指定されているため、データ制御部2側にて、その指定されているデータ分だけカウントすることにより自動的に判別されるようになっている。

【0051】分配器4からの入力情報は、次の様に処理される。分配器4よりデコーダ5へは、常に出力線S0

4によって分配器4に入った情報が入力されている。まず、文字コード情報の場合について述べると、図9の文字識別コードがデコーダ5に入力されるとデコーダ5の出力は、信号線S05を介して主制御部6に入力される。主制御部6では入力されて来る情報が文字コード情報であることを判別し、信号線S06により分配器4に対し、次の紙サイズデータをページコードバッファ制御回路7に入力する様指令する。従って紙サイズデータは分配器4よりデータ線S07を介してページコードバッファ制御回路に入力される。次に続く1行目、2行目…n行目までのデータは、分配器4よりデータ線S08を介してページコードバッファに入力される。このとき文字コードデータは、アドレスカウンタ8によって指定されたページコードバッファ9上のメモリエリアに記憶される。ページコードバッファに1ページ分の文字コード情報の入力が完了し図9のENDコードをデコーダ5で検出すると、信号線S05及びS09によって、主制御部6、ページコードバッファ制御回路7にそれぞれENDコード検出を伝える。信号線S09によって、ページコードバッファへの1ページ分の文字コード入力が完了したことをページバッファ制御回路7が確認すると、ページメモリ20へのドット単位でのデータの記憶が行われる。

【0052】ページメモリ20上でのメモリ空間と用紙との対応を図11に示す。図11に於いて破線は各用紙の外側を示す。すなわち25は用紙の先端（各サイズ共通）、24は用紙の左端（各サイズ共通）、28はA5サイズ用紙の右端、27はA4サイズ用紙の右端、26はA3サイズ用紙の右端、31はA5サイズ用紙の後端、30はA4サイズ用紙の後端、29はA3サイズ用紙の後端をそれぞれ示す。32は読出し用アドレスカウンタ19及び書込み用アドレスカウンタ18のアドレスADR（0，0）のポイントを示す。ここでADR（0，0）とは、垂直方向アドレス（ADRV）及び水平方向アドレス（ADRH）が共に“0”であることを表わす。つまり、書込み用アドレスカウンタ18及び読出し用アドレスカウンタ19は、図12に示す様に垂直方向アドレス（ADRV）と水平方向アドレス（ADRH）より成り立っており、ADRVは垂直方向アドレス（図11矢印b）を表わし、ADRHは水平方向アドレス（図11矢印c）を表わす様になっている。

【0053】43はA3サイズ用紙の最後の水平アドレス（A3HE）、44はA4サイズ用紙の水平アドレス（A4HE）、45はA5サイズ用紙の水平アドレス（A5HE）である。同様にして46はA3サイズ用紙の最後の垂直アドレス（A3VE）、47はA4サイズの垂直アドレス（A4VE）、48はA5サイズの垂直アドレス（A5VE）を表わす。33はA3サイズの垂直アドレスADRV=0、水平アドレスADRH=A3HEのポイントADR（0，A3HE）、34は同様に

してADR (O, A4HE), 35はADR (O, A5HE)をそれぞれ示す。また36はA3サイズの垂直アドレスADRV=(A3VE), 水平アドレスADRH=OのポイントADR (A3VE, O), 37は同様にしてADR (A4VE, O), 38はADR (A5VE, O)をそれぞれ示す。39はA3サイズの垂直アドレスADRV=A3VE, 水平アドレスADRH=A3HEのポイントADR (A3VE, A3HE), 同様にして40は, ADR (A4VE, A4HE), 41は, ADR (A5VE, A5HE)をそれぞれ示す。以上の様なメモリ空間を持ったページメモリ20への文字パターンのドットイメージでの記憶は次の様にして行われる。ページコードバッファ9より1行目の文字サイズデータが信号線S10を介してページコードバッファ制御回路7に読取られる。本実施例での文字サイズの種類は40×40, 32×32ドットの2種のフォントが基本となっており、ページコードバッファ制御回路7では読取った文字サイズコードにより文字サイズを判別し、その判別信号を信号線S11を介してページメモリ制御回路17へ、信号線S13を介してキャラクタジェネレータ15へそれぞれ送る。ページメモリ制御回路17では前記文字サイズ判別信号によって、改行ピッチ及びキャラクタピッチの制御を、キャラクタジェネレータ15では、文字サイズエリアの切換をそれぞれ行う。

【0054】文字サイズデータ以降の文字コードは、1行分のメモリ容量を持った行バッファ10に行アドレスカウンタ11で指定されたエリアに転送される。1行分の文字コードデータの行バッファ10への転送が終了すると、行アドレスカウンタ11は初期アドレス(0)に戻る。まず、文字フォント垂直方向第1番目のライン(図11、ライン、57)のページメモリ20への書込みが行われる。ここで、ライン/スキャンカウンタ13は初期値(0, 0)にセットされており、書込用アドレスカウンタ18の値はADR(0, 0)となっている。行バッファ10の文字コードデータは、先頭の桁より順次一定のサイクルで読出しが行われ、ラインカウンタ13との同期をとるため出力ラッチ12に順にラッチされる。先頭の文字コード(本実施例では“T”文字)が出力ラッチ12にラッチされると、その文字コードとライン/スキャンカウンタ13の出力が合成回路14で合成されキャラクタジェネレータ15の文字パターン選択コードとして、キャラクタジェネレータ15に入力される。ここで、ライン/スキャンカウンタ13の構成について説明すると、上位6ビットは、走査ラインをカウントするカウンタすなわち文字パターンの縦方向のカウンタとなっており、40×40ドットの文字の場合は0～39プラス、改行ピッチ制御ライン分カウントして“0”に戻る。下位3ビットは文字パターンの横方向のカウンタとなっており、40×40ドットのフォントの場合は0～4プラス文字ピッチ制御分カウントして

“0”に戻る(キャラクタジェネレータ15の出力は8ビット並列のためである)。

【0055】以下、フォントサイズ40×40、文字の横方向の間隔8ビット分、文字の縦方向の間隔8ビット分の場合の動作について説明する。前述の様に先頭の文字コード(“T”)が出力ラッチ12にセットされると、その文字コードとライン/スキャンカウンタ13の出力が合成回路14で合成されキャラクタジェネレータ15の文字パターン選択コードとして、キャラクタジェネレータ15に入力される。このとき、ライン/スキャンカウンタの値は(0, 0)となっているためキャラクタジェネレータ15の出力にはその文字パターンの縦方向“0”ライン目、横方向“0”番目のデータ(8ビット)が出力される。キャラクタジェネレータ15の出力データはページメモリ20への書込みの同期をとるため出力ラッチ16に一旦ラッチされページメモリ制御回路17によって書込用アドレスカウンタ18で指定されたページメモリ20上の番地へ書込まれる。この場合、書込用アドレスカウンタ18の値はADR(0, 0)となっているため、垂直アドレス“0”、水平アドレス“0”の番地へ書込まれる。そして、1バイトの文字パターンの書込が終了すると、ライン/スキャンカウンタの値は、(0, 1)に変化し、また書込用アドレスカウンタ18の値もADR(0, 1)に変化する。従ってキャラクタジェネレータ15の出力には文字パターンの縦方向“0”ライン目、横方向“1”番目のデータが出力され、前述と同様出力ラッチ16にラッチされたのち、ページメモリ20のADR(0, 1)番地に書込まれる。この様にして、1つの文字パターンの縦方向“0”ライン目の最後(“4”番目のデータ)のデータの書込みが終了すると、ライン/スキャンカウンタの値は(0, 5)、書込用アドレスカウンタ18はADR(0, 5)となる。文字の横方向の間隔は8ドット(1バイト)となっているので、キャラクタジェネレータ15の出力は、ページコードバッファ制御回路7からの指令により強制的にすべて“0”になり、ページメモリ20のADR(0, 5)番地へは“0”が書込まれ、書込動作終了後、行アドレスカウンタはプラス“1”され行バッファ10より次の文字コードが出力ラッチ12にセットされる。また、ライン/スキャンカウンタは(0, 0)、書込用アドレスカウンタ18はADR(0, 6)になる。従って次は“0”の文字パターン縦方向“0”ライン目のデータのページメモリ20への書込動作が行われる。このとき書込用アドレスカウンタ18はADR(0, 6), (0, 7), (0, 8), (0, 9), (0, A)と順次カウントアップしてゆき、それぞれOの文字パターンデータを書込用アドレスカウンタ18で指定された番地へ書込んで行く。そして書込用アドレスカウンタ18の値が(0, B)、ライン/スキャンカウンタ13の値が(0, 5)になると、前述と同様にペー

ジメモリ20には“0”が書込まれ、書込み動作終了後、行アドレスカウンタはプラス“1”され、行バッファ10より、次の文字コードが出力ラッチ12にセットされる。

【0056】また、ライン／スキャンカウンタ13は(0, 0)、書込用アドレスカウンタ18はADR(0, C)になる。この様にして順次縦方向“0”ライン目の文字パターンデータのページメモリ20への書込みが行われてゆく、そして行バッファ10の出力に“LF”コードが出力されると、“LF”コード検出信号が出力線S14を通してページコードバッファ制御回路7に伝えられ、キャラクタジェネレータ15よりの文字パターンの書込み動作は停止する。そしてそれ以降は書込用アドレスカウンタ18が順次プラス“1”され強制的に“0”をページメモリ20に書込んで行く。そして、書込用アドレスカウンタ18の値が現在A3サイズが指定されているとADR(0, A3HE)の値すなわち図11の33ポイントになると前記強制“0”書込み動作後、書込用アドレスカウンタ18はADR(1, 0)、行アドレスカウンタ11、18(0)、ライン／スキャンカウンタ13は(1, 0)にそれぞれセットされる。そして、出力ラッチ12には、行バッファ10より先頭の文字コードである“T”が再びセットされる。そして文字パターンの縦方向“1”ライン目の文字パターンデータがページメモリ20に書き込まれる。同様にして文字パターンの縦方向“2”、“3”…“39”ライン目までの書込み動作が終了すると、書込用アドレスカウンタ18はADR(28, 0)、行アドレスカウンタ11は(0)、ライン／スキャンカウンタ13は(28, 0)にそれぞれセットされる。以上で1行分の文字パターンデータの書込み動作は終了であるが、次に改行ピッチが48ラインごとであるので残り8ライン分強制的に“0”がページメモリ20に書込まれる。そして8ライン分の“0”の書込みが終了すると、書込用アドレスカウンタ18のアドレス値は、図11の61のポイントすなわち、ADR(30, 0)に行アドレスカウンタ11は(0)、ライン／スキャンカウンタは初期値(0, 0)にそれぞれセットされる。これで1行分の改行ピッチも含んだすべての書込動作が終了する。そして、行バッファ10に次の2行目の文字コードデータがページコードバッファ9より転送される。文字コードデータの転送が終了すると行アドレスカウンタ11は初期アドレス(0)に戻る。その後、1行目の文字パターンデータの書込みと同様の動作で2行目の文字パターンデータの書込みが行われる。従って2行目の文字パターンデータの書込み動作がすべて完了すると書込用アドレスカウンタのアドレス値はADR(60, 0)、行アドレスカウンタ11は(0)、ライン／スキャンカウンタは(0, 0)にそれぞれセットされる。この様にして順次、各行の文字コードをパターン化しページメモリ20上にパタ

ーンデータを書込んでゆく。そして、最終行を示す“END”コードを行バッファより検出すると、前記文字パターンのデータ書込動作は停止される。そしてページコードバッファ制御回路7より信号線S13を介してキャラクタジェネレータ15の出力を強制的に“0”にすると共にページメモリ制御回路17に対して文字パターンデータの書込終了を伝える。ページメモリ制御回路17では、前記書込終了信号を受取ると以降、紙サイズ指定されたページメモリ20中の残りのメモリエリアに対し最終のメモリ番地(A3サイズの場合図1139ポイントADR(A3VE, A3HE))まで強制的に“0”を書込む。そして図11の39ポイントに“0”を書込み、指定紙サイズ1ページ分の文字パターンデータのページメモリ20への書込み動作のすべてが完了する。そして書込用アドレスカウンタ18は、ADR(0, 0)、行アドレスカウンタ11は(0)、ライン／スキャンカウンタ13は(0, 0)にすべて初期化される。

【0057】次にホスト側システム1より送られて来るデータが画像情報の場合について述べる。図10の画像識別コードがデコーダ5に入力されると、デコーダ5の出力は信号線S05を介して主制御部6に入力される。主制御部6では入力されて来る情報が画像情報であることを判別し信号線S06により分配器4に対し、次の紙サイズデータをページメモリ制御回路17に入力する様指令する。従って紙サイズデータは、分配器4よりデータ線S07を介してページメモリ制御回路17に入力される。次に続く画像データ1, 2, …mまでの画像データは分配器4より、データ線S15を介してページメモリ20に入力される。ページメモリ20への画像データの入力方法は次の様に行われる。ページメモリ制御回路は前記紙サイズ識別コードを受けると次に続く画像データを、図11の32ポイント(アドレスADR(0, 0))から書込むべく書込用アドレスカウンタ18をADR(0, 0)にセットする。そして紙サイズ識別コードより水平方向1ライン分のデータ長が、ページメモリ制御回路17内のテーブルを参照することによって決まる。従って、これからページメモリ20に入力する画像情報の紙サイズがA4であるとするならば、1ラインのデータ長は図11の44ポイント(A4HE)までの値、すなわち“A4HE”となる。ホスト側システム1より送られて来る1ライン当りの画像情報の長さも当然“A4HE”となっているので、第10図の画像データ1, 画像データ2, …画像データm共データ長は“A4VE”であり、画像データ数mは、図11の47ポイントの値、すなわち“A4VE”となっている。従ってページメモリ20へは、図10の画像データ1は、図11の、32ポイントADR(0, 0)～34ポイントADR(0, A4HE)、画像データ2は51ポイントのライン、画像データ3は52ポイントのライン…画像データmは37ポイントのライン従って最終アドレスは40

ポイントADR (A4VE, A4HE) となる。この様に書込用アドレスカウンタ18を制御しながら、ページメモリ20へ画像情報を書込む。

【0058】この様にしてページメモリ20に書込まれた文字パターンデータ13は、読出し用アドレスカウンタ19に示されたアドレスのデータを順次出力ラッチ21、ゲート回路23、インターフェイス22を通してインターフェイスバスS17を介して印字制御部に印字するデータを送出する。図8に於いてS17は印字制御部からのステータスデータ線、S18は印字制御部へ動作モードの指定等を行なうコマンドデータ線、S19及びS20はコマンドデータ及び印字データ送出時のストローブ信号線、S21は、印字制御部よりのビジー信号線、S22は、印字制御部よりの水平同期信号線、S23は同じく印字データの終了を知らせるページエンド信号線、S24は、印字制御部のレディー信号線、S25は印字可能な状態を知らせるプリントリクエスト信号線、S26は前記インターフェイスバスS17中のデータラインのデータ内容を指定するセレクト信号線(2ライン)、S27は印字制御部に対し印字動作の開始を指令する印字開始信号線である。

【0059】印字制御部へのデータ送出時についてさらに詳しく説明すると、データ制御部2よりの印字は開始信号線S27に対し印字制御部は水平同期信号S22を送って来る。この水平同期信号S22によって先ず、図11の32ポイントのライン、次の水平同期信号S22で51ポイントのラインの各データを順次送出してゆく、従って読出し用アドレスカウンタ19も、前記水平同期信号S22に従って順次1ラインずつ、アドレスを変化させてゆく、そして、印字制御部からのページエンド信号S23を受けとるまで、この動作を繰返してゆくページメモリ20の指定されたエリアのデータを印字制御部に送出してゆく、そして、ページエンド信号S23を受けとると強制的にデータの送出を停止する。印字制御部ではページエンド信号S23を出すタイミングは、前記水平同期信号S22と同じタイミングで出す。また、図11のメモリアドレスとの対応では、その紙サイズのメモリアドレスの最終ラインA3では46ポイント、A4では47ポイントと同じか、またはそれ以前のタイミングで印字制御部より出力される。

【0060】またページメモリ制御回路17では、ページメモリ20よりの印字データの送出が開始されると、常に読出し用アドレスカウンタ19と書込用アドレスカウンタ18の値を比較し、読出し用アドレスカウンタ19の値の方が大きければ、そのデータの送出が終了したメモリアドレスエリアに対し書込み動作を許可する様に制御される。従って、ページメモリ20への書込時間のロスが非常に少なくなる。

【0061】図13は図1に於ける印字制御部100のブロック図を示す。図13に於いて101は印字制御部

100内の各ユニットの制御を行うためのマイクロプロセッサ、102はマイクロプロセッサ101に対する割込を制御するための割込制御回路であり、インターフェイス回路122よりのコマンド信号線S30、印字データ書込制御回路19よりのページエンド信号線S29、汎用タイマー103よりのタイムアウト信号線S28のそれぞれからの割込要求信号をマイクロプロセッサ101へ伝える。103は汎用タイマーであり、紙搬送及びドラム廻りプロセス等の制御用基本タイミング信号を発生する。この汎用タイマー103は、本実施例では10msecに設定されている。104はROM(リードオンリーメモリ)であり印字制御部100を動作させるためのすべての制御用プログラムが入っている。105は同じくROMであり前記ROM104とは違うデータテーブルが入っている。データテーブルの内容を図45に示す。図45に於いてアドレス(4000, 4001)には紙サイズA3の場合のトップマージン制御用データ、アドレス(4002, 4003)にはボトムマージン制御用データ、アドレス(4004, 4005)にはレフトマージン制御用データ、アドレス(4006, 4007)にはライトマージン制御用データがそれぞれ入っている。同様にアドレス(4008~400F)には、紙サイズB4の場合のトップ、ボトム、レフト、ライトの各マージン制御用データが入っている。以下アドレス(4087)まで各種の紙サイズに対応するマージン制御用データが入っている。そして、これらのマージン制御用データは、後述する印字データ書込制御回路119内のマージン制御用カウンタのセットデータとして使用される。

【0062】アドレス(4100~41FF)までは、データ制御部2よりの動作指定用のコマンドコードのテーブルが入っており、データ制御部2よりのコマンドコードチェック用に使用される。コマンドの内容は、トップ/ボトムマージン変更テーブル、トップマージン調整テーブル、カセット上/下調整テーブル、カセット/手差し調整テーブル等である。アドレス(4200~42FF)までは、感光ドラム301の帯電特性のデータが入っており、A~Fの5種類のデータが入っている。そして、このデータは後述する帯電用チャージャ304の温度補正制御に使用される。アドレス(4300~43FF)までは、交換データテーブルとなっており、感光ドラム301、現像器307内の現像剤、定着ローラ332の各交換サイクルデータが入っている。

【0063】アドレス(4400~47FF)までは、制御用タイマーテーブルとなっており各プロセスタイミング、給紙タイミング等、印字動作を行うための各種タイマー値が入っている。

【0064】106はRAM(ランダムアクセスメモリ)で、ワーキング用のメモリアドレスであり、その中には図46に示すように、タイマー(TIM)A, B, …,



E、紙サイズレジスタ（後述するカセットサイズ検出スイッチ320、324の信号によるカセットサイズデータを記憶している）、ステータス1～6及びその他の内容が入っている。前記マイクロプロセッサ101は、紙サイズレジスタに記憶されるカセットサイズと、前記データ制御部2から送られてくる外部装置からの記録情報（画像データ等）のサイズとを比較し、カセットサイズの方が大きければ後段の印字制御部100に印字動作指令を出すようになっている。従って、印字用紙が外部から送られてくる情報サイズより大きくても印字することができ、利用度の向上が図れる。107は不揮発性RAMで電源遮断時もメモリ内のデータは保持されるようになっている。また前記不揮発性RAM内のデータ内容を図45に示す。図45に於いてアドレス（6000）は交換モードによって操作部より入力されたドラム特性NOが入っており、アドレス（6100）には、ジャム発生時のジャム情報が入っており、ジャム時、一旦電源がOFFされたときの機内のジャム紙の処理忘れの防止に使用される。アドレス（6200）は、反転トレイ381内の用紙をカウントする排紙トレイカウンタで、反転トレイ381に用紙が1枚送られるごとに1ずつカウントアップされる。このカウント値が規定値まで達するとトレイフル状態になりオペレータに対し用紙をトレイより取り出すよう操作部に表示する。また本排紙トレイカウンタはオペレータによって用紙がトレイより取出されると自動的にクリアされる。従って、電源がOFFされても、トレイに残っている用紙の数は本カウンタによって保持されている。

【0065】アドレス（6300）は、ドラム交換カウンタであり、印字1回につき1ずつカウントアップする。本カウンタの値が前記図45の交換テーブル（ドラム）の値に達したとき、操作部の表示によって、オペレータにドラムの交換を知らせる。

【0066】アドレス（6400）は現像剤交換カウンタであり前記ドラム交換と同様印字毎に1ずつカウントアップされ、本カウンタの値が、前記図45の交換テーブル（現像剤）の値に達したとき操作部に表示する。

【0067】アドレス（6500）は、定着ローラ交換カウンタであり、前記ドラム交換と同様印字毎に1ずつカウントアップされ、図45の交換テーブル（定着ローラ）の値に達すると操作部に表示する。

【0068】108は電源シーケンス回路であり、前記不揮発性RAM107の電源ON時又は電源OFF時の誤操作を防止する働きを持っている。399は制御部への電源を供給する電源装置である。110は入出力ポートであり操作表示部111への表示データの出力及び各操作スイッチデータ等の読取を行う。112は印字制御部100内の各検出器113よりの入力データを読取る入力ポートである。116はモータ、高圧電源ランプ、

ソレノイド、ファン、ヒータ等の駆動素子を示す。115は前記駆動素子116の駆動回路であり、114は前記駆動回路115への出力信号を与える出力ポートである。312はレーザービームを操作するためのレーザースキャンモータ、118はその駆動回路であり、117は前記駆動回路への駆動制御信号を与える入出力ポートである。

【0069】344は半導体レーザー、120は前記半導体レーザーの光変調を含む制御を行うレーザー制御装置としてのレーザー変調回路、346は前記レーザースキャンモータによって操作されている光ビームを検出するビーム検出器であり、高速応答するPINダイオードが使用されている。121は前記ビーム検出器からのアナログ信号をデジタル化し、水平同期パルスを作るための高速コンパレータ、119はデータ制御部2より転送されてきたビデオイメージの印字データを、感光体301上の所定の位置へ書込む制御及びテストパターン印字データの発生等を行う印字データ書込制御回路である。122はデータ制御部2へのステータスデータの出力、データ制御部2からのコマンドデータ及び印字データの受取り等の制御を行うインターフェイス回路である。

【0070】以下、図13に於ける主要ブロックの詳細について説明する。図14は、図13に於ける各種検出器113の詳細回路図である。図14において、各種の検出器よりの信号はマルチプレクサ139に入力される。マルチプレクサでは、セレクト信号S31によって8ビットの信号S32によって図13の入力ポート112に入力される。

【0071】320は上段カセットサイズ検出スイッチであり、4箇のスイッチより構成され、それらの組合せにより紙サイズを表わすようになっている。324は、下段カセットサイズ検出スイッチであり、構成は前記上段カセットサイズ検出スイッチと同様である。319は、カセット上段紙なしスイッチであり、カセットに紙がなくなるとスイッチがONになる。323は、下段の紙なしスイッチである。123は、レジストローラ前バスセンサーでありcds受光素子が使用されている。本センサーは、バイアス電圧が、抵抗を通して印加されており（図示していない）用紙の有無によって出力電圧が変化する。従ってその出力を基準電圧Vref1が印加されているコンパレータ124に入力することにより、用紙の有無を判別する信号が得られるようになっている。

【0072】326は、手差しガイド325よりの用紙を検出するマニュアルフィードスイッチ、336は定着ローラ部にある排紙スイッチ、395は排紙トレイ部にある排紙スイッチを示す。125はトナーボックス中のトナーなしを検出するトナーなし検出スイッチ、126はトナーバックにトナーが満杯になったとき動作するトナー満杯検出スイッチをそれぞれ示す。

【0073】127は現像剤のトナー比濃度の検出センサー（プローブ濃度検出センサー）であり、フォトダイオードが使用されている。本センサーはバイアス電圧が抵抗を介して印加されており、トナーの濃度によって出力電圧が変化する。従ってその出力をコンパレータ128に入力することにより、コンパレータ128の他方の入力端子には基準電圧Vref2が印加されているため、トナー濃度が規定値以上又は以下でそれぞれ1又は0の信号が得られる。

【0074】129はフロントカバーの開閉によって、ON/OFFするドアスイッチ、130は定着器に設けられている温度フューズ、131は駆動用電源（+24VB）をON/OFFさせるMCリレーである。前記温度フューズ130の一方は電源+24VAに接続されているため、温度フューズ130が定着器の異常により溶断した場合、前記MCリレー131はOFFされ駆動用電源がOFFされる。また温度フューズ130は、抵抗R01に接続されており、抵抗R01の一方は抵抗R02とコンパレータ132の入力に接続されている。またコンパレータ132の他の入力には基準電圧Vref3が印加されている。従って温度フューズ130が溶断するとコンパレータ132の入力は0Vになる。よってコンパレータ132の出力には、温度フューズの溶断検出信号が出力される。133は仕向先切換スイッチであり具体的には、本スイッチのON/OFFにより、ON状態は国内向（A及びBサイズ）、OFFは米国向（リーガル、レターサイズ）となっている。従ってたとえば前記上段又は下段のカセットサイズスイッチ（4ケ）によるコードの組合せが同一でも本スイッチの状態によって、国内向/米国向どちらかの紙サイズを選択する。

【0075】134はジャムリセットスイッチであり、フロントカバーの中に設置されている。本スイッチは紙ジャム又はトナー満杯のオペレータコールが生じた場合オペレータがジャム処理又はトナーバッグを交換したのち確認の意味でONするスイッチである。従って前記処理後このスイッチをONしないと、ジャム又はトナー満杯の操作部表示はクリアーされない。392は図5中のトレイ内の用紙の検出を行う排紙トレイセンサーである。334は定着器の温度を検出するサーミスタで、このサーミスタの検出温度が一定になる様制御される。サーミスタ334の出力は抵抗R03とコンパレータ136、137の入力側に接続されている。従ってコンパレータの入力電圧はサーミスタ334の温度による抵抗値変化に伴って変化する。すなわち温度が高くなるとその入力電圧は、高くなる。コンパレータ136の他方の入力端子には、抵抗R06とR07で分圧された電圧が印加されており、この分圧された基準電圧よりも、高いか低いかによって、コンパレータ136の出力は変化する。また、抵抗R06とR07の接続点には抵抗R08が接続されておりその一方はトランジスタ138のコレ

クタに接続されている。従って、このトランジスタ138が入力信号（パワーセーブ信号）S3によってONすると、コンパレータ136の基準電圧は、抵抗R08によって低くなり、定着器の温度制御は、トランジスタ138がOFFしているときよりも低くなる。よって、定着器の消費電力は低くなり、パワーセーブ状態となる。またコンパレータ137の基準電圧は抵抗R04、R05の分圧によって与えられる。そしてこのコンパレータ137の基準電圧は前記コンパレータ136の基準電圧よりもかなり低く設定してあるので、プリンターの動作中のヒータ断線あるいはヒータの駆動回路の故障による定着器の温度低下を検出することができる。そしてコンパレータ136の出力S33は、一方はマルチプレクサ139に入力されており、マイクロプロセッサ101によって読取られる。なお、この入力信号は、定着器のレディー状態の検出の意味で使用される。また、他方は、図15の定着器ヒータランプ333の駆動信号として使用される。

【0076】342は、感光体301付近の温度を検出するドラム温度センサーである。サーミスタ342の出力側は、抵抗R58とオペアンプ270の入力に接続されている。従って、感光体301付近の温度変化によって前記サーミスタ342の抵抗値も変化する。よって、オペアンプ270の入力電圧も変化する。オペアンプ270の出力電圧は感光体301の温度が低い場合は低電圧が、温度が高い場合は高電圧がそれぞれ出力される。オペアンプ270はボルテージフォロワとなっており、その出力は、A/Dコンバータ271の入力に接続されている。そして、A/Dコンバータ271によって、前記オペアンプ270の出力電圧をデジタル値に変換しマルチプレクサ139を通してマイクロプロセッサ101に読取らせる。このA/D変換された感光体301の温度データは後述する感光体301の帯電補正に使用される。440はカセット上/下段調整スイッチであり、441はカセット/手差し調整スイッチであり、442はトップマージン調整スイッチである。

【0077】図15は、図13に於ける駆動回路115と出力素子116の詳細なブロック図である。図15に於いて、141は現像器モータでありDC駆動のホールモータが使用されている。140は前記現像器モータのドライバーであり、PLL制御を行なっている。143は定着器モータであり、DC駆動のホールモータが使用されている。142は前記定着器モータ143のドライバーであり、PLL制御を行なっている。145は、機内冷却用のファンモータであり、DC駆動のホールモータが使用されている。144は前記冷却ファンモータのドライバーであり、前述の現像器及び定着器ドライバーの様なPLL速度制御は行っていない。147は感光体ドラム301の駆動用モータであり、4相パルスモータを使用している。146は前記ドラムモータ147の

ドライバーであり、定電流1-2相励磁方式を採用している。なお速度は1200PPS程度の振動の発生が少ない部分で駆動している。149はレジストローラ329及び手差しローラ327を駆動させるレジストモータでパルスモータである。148は前記レジストモータのドライバーであり、定電圧2相励磁方式を使用している。速度は400PPS程度である。

【0078】なおレジストモータ149は、回転方向を正転にするとレジストローラ329が回転し、反転させると、手差しローラ327が回転する。これらはワンウェイクラッチを介して伝達されるようになっている。

【0079】151は、下段給紙ローラ322及び上段給紙ローラ318を駆動させる給紙モータでパルスモータである。上記同様正、逆回転をワンウェイクラッチを介して伝達している。150は前記給紙モータ151のドライバーであり、前記レジストモータドライバー148と同様定電圧2相励磁を使用している。速度は400PPS程度である。

【0080】302は、帯電前に感光体301上の残留電荷を除去する除電ランプであり、複数個の赤色LEDで構成されている。R10は前記除電ランプ302の電流制御抵抗であり、152は除電ランプ302のドライバーである。303は転写チャージャ前におかれた転写効率を上げるための転写前除電ランプであり、複数個の赤色LEDで構成されている。R11は前記転写前除電ランプの電流制御抵抗であり、153は前記転写前除電ランプのドライバーである。158はトナー回収用ブレードのソレノイドで、このソレノイドがONになると感光体301にブレード310が押し当てられる。154は前記ブレードソレノイド158のドライバーである。159はトナーホッパーから現像器307にトナーを補給するためのトナー補給モータであり、このトナー補給モータが回転することにより前記トナーホッパーより現像器307にトナーを補給する。このトナー補給モータ159の動作は、前記図14のプロブ濃度検出センサーの出力に応じて動作する。155は前記トナー補給モータ159のドライバーである。131は前記図14と同様のドアスイッチに連動して働くMCリレーであり、156はそのドライバーである。そして、図15に示すようにMCリレー131を省くモータ及びランプ等の電源側コモンは前記MCリレー131の接点163に接続され、その接点の他方は+24VB電源に接続されている。従ってMCリレー131がONしているときに、前記モータ及びランプを動作させることができる構成になっている。

【0081】304は帯電用のチャージャでありチャージャのケースは、機体のアースに接続されている。チャージャのコロナ放電用ワイヤーは、高圧電源338の帯電用高圧電源160の出力端子に接続されており、帯電用高圧電源の入力には、高圧出力のON/OFF信号

線S35と、高圧出力電流を変化させるアナログ制御信号線S36が接続されている。またアナログ制御信号線S36はD/Aコンバータ165に接続されており、マイクロプロセッサ101よりの帯電電圧制御データ線S37のデータによって、D/Aコンバータ165でアナログ電圧化し前記帯電用高圧電源の出力電流を制御する。306は剥離用チャージャ、剥離チャージャ306は剥離用高圧電源161の出力に接続されている。前記剥離用高圧電源はAC出力となっている。305は感光体301上の現像されたトナーを用紙に転写させるための転写チャージャ、転写チャージャは転写用高圧電源62の出力に接続されている。また転写用高圧電源は、前記転写チャージャ出力以外に現像器バイアス電源も組込まれており、その出力線S38は現像器マグネットローラ308に接続されている。この電圧によって前記マグネットローラ308にバイアス電圧が印加され現像バイアスが与えられる。33は定着器のヒータランプであり、片側はAC100Vの電源の一方に接続されている。また他方はMCリレー131の第2の接点164に接続されており、その一方はヒータ駆動回路166に接続されている。従ってヒータランプ333は前記MCリレー131がONのときのみ動作する。またヒータ駆動回路166には、2つの入力信号S33とS39が入力されており、S33は前記図14の定着器内サーミスタ334からの信号であり、定着器の濃度制御信号である。S39はマイクロプロセッサ101からのヒータランプ333の強制OFF信号である。

【0082】図16は図13に於けるレーザースキャンモータ312とその駆動回路118の詳細回路図である。図16に於いて312は、レーザースキャンモータ内部の回路図である。L02、L03、L04はモータのコイルを示し、180、181、182はそれぞれモータの回転子の位置を検出するホール素子である。183、184、185は前記ホール素子180、181、182用のコンパレータであり、その出力は駆動回路118内の前記モータコイルL02、L03、L04をドライブするパワートランジスタ171、172、173のベースに抵抗R26、R27、R28を通して接続されている。また前記パワートランジスタ171、172、173のベースとエミッタの間には、ベース抵抗R23、R24、R25がそれぞれ接続されている。モータの回転子の回転に伴って前記ホール素子180、181、182は、180、181、182の順にONする。従ってコンパレータ183、184、185の出力も183、184、185の順にLOWレベルになる。よってパワートランジスタは173、172、171の順にONになりL02、L03、L04の順に、駆動電圧が印加されることにより、レーザースキャンモータ312は回転する。またコンパレータ185の出力はダイオードD02を通して、抵抗R30及びコンデンサC0

6, インバータ174による波形整形回路を通して分周カウンタ175に入力されている。分周カウンタ175の出力端Q1及びQ2の出力は、モータスピード切換ゲート176, 177に接続されており、前記スピード切換ゲートの出力はORゲート178を通してPLL (フェイズ、ロック、ループ) 制御ICのFG入力に接続されている。また前記スピード切換ゲート176, 177の一方の入力にはスピード制御信号線S40の出力及びその反転出力が接続されている。従ってS40がLOWレベルの場合には切換ゲート177が有効となり分周カウンタのQ1の出力が前記PLL制御IC167のFGに入力され、S40がHIGHレベルのときは切換ゲート176が有効になり、分周カウンタ175のQ2出力がPLL制御IC167のFG入力に入力される。ここでPLL制御IC167の入出力信号について簡単に説明すると、P/S端子 (PLAY/STOP) はHIGHレベルでストップ、LOWレベルでスタートとなる。HIGHレベルの場合AGC, APCの両端子共出力はHIGHレベルとなる。FGINは、制御するモータからの回転モータパルス信号入力、N1, N2は本IC内部の基準分周器の分周数を切換る信号、33/45はモータの回転数の切換信号、CPOUTは水晶基準分周出力信号、CPINは基準周波数入力、LDはロック検出信号でモータの回転数がロック範囲内にあるときはHIGHレベル、それ以外はLOWレベルが出力される。AFCはモータの速度制御系出力でPLL IC内部の8ビットD/Aコンバータ出力、APCはモータの位相制御系出力でPLL IC内部の8ビットD/Aコンバータ出力である。またPLL IC167に接続されているX01は基準周波数発生用の水晶振動子、C01, C02は発振用コンデンサである。

【0083】PLL制御用IC167のAFC, APCの出力端子は抵抗R12, R13で加算回路を構成しオペアンプ168の-側入力端子に接続されている。オペアンプ168の+側入力端子には、+12Vを抵抗R14とR15で分圧した電圧が印加されている。また抵抗R16とコンデンサC03で負帰還回路を構成しており、特にコンデンサC03はハイパスフィルターの役目をする。従ってオペアンプ168の増幅度はある周波数以上の入力に対しては、減衰する特性を持たせてある。オペアンプ168の出力はパルス幅変調型スイッチングレギュレータIC169の+側入力端子に接続されている。169は一般市販品のパルス幅変調型スイッチングレギュレータICである。本IC169とパワートランジスタ170, ダイオードD01, コイルL01, コンデンサC05とで、ダウンスイッチングレギュレータ回路を構成している。IC169の入出力に於いて、一端子は比較基準電圧端子で、IC169内部の基準電圧出力端子VREFの電圧を抵抗R17, R18で分圧した基準電圧が印加されている。DEAD TIME端子は出

力の最大のパルス幅を規制するもので、前記VREFを抵抗R19, R20によって分圧した電圧が印加されている。C1, C2は出力端子であり、+側入力端子電圧に依じて、パルス幅が変化する。すなわち+側入力端子電圧が-側入力端子電圧よりも低いと、C1, C2のLOWレベル側のパルス幅は小さくなり、パワートランジスタ170がONする幅も同様小さくなる。従ってコンデンサC05の両端電圧も小さくなる。また+側入力端子電圧が-側入力端子電圧よりも高いと前記とは逆に、C1, C2のパルス幅は大きくなりコンデンサC05の両端電圧も大きくなる。

【0084】以下スキャンモータ312の回転数制御について説明する。

【0085】スキャンモータ312の回転開始信号S42がLOWレベルになると、PLL制御用IC167のAFC, APCの両出力は前述のロック信号S41が出力されるまではLOWレベルとなっているので、オペアンプ168の出力は、HIGHレベルの電圧が出力される。従って、レギュレータIC169の出力パルス幅は大となりコンデンサC05の両端電圧は約+16V程度となる。そしてモータの回転子が停止している位置で前記ホール素子180, 181, 182のいずれか一つがONになっているので、モータコイルL02, L03, L04のうち前記ホール素子180, 181, 182に対応したコイルが励磁されスキャンモータ312は回転を始める。そしてスキャンモータ312は回転を早めて行く。今スピード制御信号線S40のレベルはHIGHになっているため、分周カウンタ175のQ2出力が、PLL制御IC167のFG入力端子に加えられる。従って分周カウンタ175は8分周回路として働いている。FGINに加えられる信号の周波数がPLL IC169内部の基準周波数の約96%に達するとロック信号LD S41がHIGHになりAFC, APC出力レベルはLOWレベル (OV) 固定でなく、PLL IC内部D/Aコンバータの出力電圧に切換られる。従って以降は、速度制御系出力AFCと、位相制御系出力APCとによってスキャンモータ312が一定のスピードになる様制御される。

【0086】また、本実施例ではある一定時間 (約5分) プリントの指令がデータ制御部2より来ないときスキャンモータはスタンバイ状態となりスピード制御線S40の出力はLOWレベルになる。従って分周器175は、前の8分周から4分周となるため、スキャンモータは、4/8すなわち1/2の回転数になる。これは、長時間高速回転を行っていた場合モータの軸受等の信頼性問題が発生するのを防ぐため前述のようなハーフスピード制御を行っている。なお本実施例では印字動作時、即ち高速回転時は約12, 000rpm, スタンバイ時は約6000rpmである。

【0087】図17は図13におけるレーザ変調回路1

20と半導体レーザー344の詳細回路図である。図17において、344は光ビーム発生手段である光ビーム発生手段たる半導体レーザーダイオードでその構成は発光するレーザーダイオード259と、レーザーダイオード259からの出力ビーム強度をモニターする光検出手段であるモニター用フォトダイオード260から成っている。257は電圧-電流変換手段（又は第1の電流駆動手段）である高周波用トランジスタでレーザーダイオード259の光変調を行う（制御手段）。抵抗R50は電流検出用抵抗、258はレーザーダイオード259にバイアス電流を流すための第2の電流駆動手段であるトランジスタで（レベル選択手段）、R51はその電流制限抵抗、R52はトランジスタ258のベース電流制限抵抗である。254、255、256はレーザーダイオード259に変調を与えるための高速アナログスイッチで、それぞれのアナログスイッチは、ゲート（G）にHIGHレベルの電圧が印加されるとドレイン（D）、ソース（S）間が低抵抗となりON状態になる。LOWレベルの電圧がゲート（G）に印加されると逆に高抵抗となりOFF状態になる。レーザー259からの出力パワーは本レーザープリンタの場合3つのレベルを持っている。第1は用紙上での白地に相当する部分で感光体301の帯電された電荷をほぼ完全に除去するための出力P（ON）でアナログスイッチ254をONすることによりレーザーダイオード259は、前記出力P（ON）となる。第2は用紙上での黒地に相当する部分で、感光体301上の帯電された電荷はそのままにするため出力“0”状態すなわち出力P（OFF）で、アナログスイッチ256をONすることにより、レーザーダイオード259は出力OFFすなわちP（OFF）となる。第3は前記第1の出力P（ON）と第2出力P（OFF）の間の出力P（SH）で1ドットラインの印字濃度を上げるためのものであり、アナログスイッチ255をONすることによりレーザーダイオード259は、前記出力P（SH）となる（P（SH）の詳細については後述する）。

【0088】抵抗R42、R43はアナログスイッチ254、255、256のON/OFF変化時の短絡保護抵抗、249、250、251は前記アナログスイッチ254、255、256のゲートドライバーである。C09、C10、C11は、スピードアップ用のコンデンサ、R47、R48、R49は前記ゲートドライバー249、250、251の入力抵抗である。

【0089】246は3NANDゲートで3つのゲート入力のすべてがHIGHレベルになったとき、出力はLOWレベルになり前記アナログスイッチ254をONにし、レーザーダイオード259は前記出力P（ON）状態になる。3つの入力ゲートのうち第1はインバータ253の出力に接続されており、インバータ253の入力は印字データ信号S47（HIGHレベルで印字するL

OWレベルで印字しない）に接続されている。第2はインバータ252の出力に接続されておりインバータ252の入力はシャドウ信号S48（HIGHレベルでシャドウオン、LOWでオフ）に接続されている。第3はレーザーイネーブル信号S49（HIGHレベルでレーザーイネーブル、LOWでレーザー強制OFF）に接続されている。従って前記NANDゲート246の出力がLOWレベルになる条件は、レーザーイネーブル信号S49がHIGH、シャドウ信号S48がLOW、印字データ信号S47がLOWのときである。次に247は3NANDゲートで3つのゲート入力のすべてがHIGHレベルになったとき出力はLOWレベルになり前記アナログスイッチ255をONにし、レーザーダイオード259は前記出力P（SH）状態になる。3つの入力ゲートのうち第1は前記シャドウ信号S48に、第2は前記印字データ信号S47の反転信号であるインバータ253の出力に、第3は前記レーザーイネーブル信号S49にそれぞれ接続されている。従って前記NANDゲート247の出力がLOWレベルになる条件は、レーザーイネーブル信号S49がHIGH、シャドウ信号S48がHIGH、印字データ信号S47がLOWのときである。次に248は2ORゲートで、2つのゲート入力のうちどちらか一方のゲート入力がLOWレベルになると、出力はLOWレベルになり、前記アナログスイッチ256をONにし、レーザーダイオード259はOFF状態出力P（OFF）状態になる。

【0090】245は、サンプルアンドホールドICであり、レーザーダイオード259の出力を前記シャドウ出力P（SH）に制御するために用いられている。ANALOG-INPUTはサンプルするアナログ電圧入力、SAMPLECはホールド用コンデンサC08の接続端子、STROBEはサンプリングのストロブ信号端子であり、サンプルストロブ信号S46に接続されている。237はFET入力のオペアンプでありボルテージフォロア回路を構成している。DO3はツェナダイオードでレーザーダイオード259の出力が最大定格以内になるよう規制している。また抵抗R40とコンデンサC07で積分手段としての積分回路を構成しており、抵抗R41は前記コンデンサC07の電荷を一定の割合で放電させる放電用抵抗である。236はスイッチング手段としてのアナログスイッチでありそのゲート（G）はバッファ244に接続されておりバッファ244の入力にはサンプル信号S45が入力される。253はレベル変換用のトランジスタ、R39は前記コンデンサC07への充電時の電流制限抵抗として働く。R38はトランジスタ235のベース電流制限抵抗、234は比較手段であるコンパレータであり、このコンパレータは、抵抗R34、R35の働きによりヒステリシス特性を持たせてある。コンパレータ234の+入力側には前記抵抗R34を通してレーザーモニター増幅器232の

出力電圧が印加されている。232は、レーザーダイオード259からの光出力を検出するフォトダイオード260の出力の増幅器であり、電流-電圧変換手段として供するものである。抵抗R32, R33, VRO1は前記オペアンプ232の増幅度を規制する抵抗である。従ってボリュームVRO1を変化することによりオペアンプ232の増幅度を変化させることができる。R31は、前記半導体レーザー344内のフォトダイオード260の出力用負荷抵抗であり、フォトダイオード260の出力電流に比例した電圧が得られる。フォトダイオード260の光出力Poに対する短絡電流Isの関係を図19で示す。図19においてIsはモニター電流、Poはレーザーダイオード259の光出力を示す。前記P(ON)の出力は約6mw、P(SH)の出力は約4mw、P(OFF)は0になっている。またLA-A, LA-Bは2通りのレーザーダイオードのモニター特性を表わしている。通常前記ボリュームVRO1は、レーザーダイオード光出力が6mw時に、オペアンプ232の出力電圧が3V程度になるよう調整されている。従って、図19のグラフLA-A及びLA-Bのどちらの特性でも、前記ボリュームVRO1によって調整できるようになっている。238はレーザーダイオード259が発光しているかどうかを確認するコンパレータであり、+側入力には前記オペアンプ232の出力電圧が印加されている。また-側には抵抗R36, R37によって分圧されて電圧(この場合約2.0Vに設定してある)が印加されている。従って、レーザーダイオード259が発光し、その出力が約2mwレベルは、LOWレベルからHIGHレベルに変化しレーザーレディ信号S43が出力される。また前記コンパレータ234の-側入力端子にはレーザーの光量設定電圧が印加される。前記設定電圧は、アナログスイッチ240又は241のどちらか一方から与えられる。すなわち、アナログスイッチ240は前記レーザー出力P(ON)の設定時にONとなりボルテージフォロア239の出力電圧が前記コンパレータ234の-側入力に印加される。ボルテージフォロア239の入力端子には、第1の電圧可変手段であるメイン露光調整ボリューム360と抵抗R45によって分圧されて電圧が入力されており、前記メイン露光調整ボリューム360を可変することによりコンパレータ234の-側端子の電圧も変化する。またアナログスイッチ241は前記レーザー出力P(SH)の設定時にONとなり、前記ボルテージフォロア239の出力電圧を抵抗R46と第2の電圧可変手段であるシャドウ露光調整ボリューム361によって分圧された電圧が前記コンパレータ234の-側入力端子に与えられる。上記のボルテージフォロア239、アナログスイッチ240, 241、メイン露光調整ボリューム360, 抵抗R45, シャドウ露光調整ボリューム361, 抵抗R46で光出力設定手段を構成している。また、モニター用フォトダイオ

ード260で検出され、モニター増幅器324で増幅された電圧をコンパレータ234で設定電圧と比較し、その比較値を積分する回路を光出力安定化手段と称する。

【0091】そして、前記アナログスイッチ240, 241の切換はメイン露光設定信号S44によって切換えられる。すなわち、前記メイン露光設定信号S44がLOWレベルの場合はインバータ242の出力レベルがHIGHレベルになりアナログスイッチ241がONする。また、前記メイン露光設定信号S44がHIGHレベルの場合は、バッファ243の出力がHIGHレベルになりアナログスイッチ240がONする。また、アナログスイッチ240, 241の出力(S側)は、ボルテージフォロア261にも入力されており後述するビーム検出回路の水平同期パルス検出コンパレータのスレッシュホールドレベルの補正に前記ボルテージフォロア261の出力S50が使用される。

【0092】次に、本プリンタにて使用しているレーザーダイオードの電流-出力特性について説明する。図18はそのIF-Po特性のグラフである。TC=0℃はレーザーダイオード344のケース温度0℃時のIF-Po特性、同じくTC=25℃はケース温度25℃時、TC=50℃はケース温度50℃時のIF-Po特性である。ケース温度TC=25℃の特性を例にとると、レーザーダイオード259に流す電流IFを0から順次増加させてゆくと、約50mAの点より光出力Poが出力され始める。そして、IF=68mAのポイントで、前記P(ON)の光出力である6mwとなる。従って、TC=0℃の場合でも光出力Poが出力され始めるのは約40mAのポイントであるので、前記トランジスタ258をONすることにより、前記レーザーイネーブル信号S49がHIGHレベルのときには常にバイアス電流IFBを流し、前記レーザー変調用トランジスタ257のパワー損失を少なくするようになっている。従ってレーザー変調用トランジスタ257は前記バイアス電流IFBの作用によって高温時でもきわめて安定度のある動作が保証される。またレーザーを変調するに必要な電流の変化量が、例えばTC=25℃の場合には、IF25-IFBの値でよくIF25の電流を直接トランジスタ257でドライブすることに比べ後述する光量安定化動作の精度をかなり良くすることができる。またグラフからも明らかなようにレーザーダイオード自体の特性としてかなり温度によって出力が変化するため前記光量安定化回路が必要になってくる。本レーザー光量安定化回路はレーザーダイオード259からの光量をモニターフォトダイオード260で検出しそのフォトダイオード260の短絡電流Isが常に一定量になるように制御される。なぜならば、図19からも明らかなようにモニター短絡電流Isとレーザーダイオード259の光出力Poは完全な比例関係にあるためモニター電流Isを一定に保てば光出力Poは常に一定に保たれる。またフォトダイオ

ード260の温度によるドリフトも非常に小さいためたとえ温度が変化しても光出力の変化量は無視できる。次に図17と図20を使用して上述の光出力安定化回路の動作について説明する。

【0093】図20においてレーザーイネーブル信号S49及びサンプル信号S45が共にHIGHレベルになると、図17のトランジスタ258がONになり、抵抗R51を通してレーザーダイオード259にバイアス電流(約30mA)が流れる。また、この時は印字データ信号S47及びシャドウ信号S48は共にLOWレベルとなっているので、ゲート246, 247, 248のうちゲート246のみ入力がすべてHIGHレベルとなるため出力はLOWレベルになりアナログスイッチ254, 255, 256のうちアナログスイッチ254がON状態になる。また、サンプル信号S45がHIGHになることによってアナログスイッチ236がONとなる。このときまだコンデンサC07は、チャージされていない状態のためオペアンプ237の出力はOVとなっており、レーザー変調用トランジスタ257のベースもOVとなる。従ってこの時点ではレーザーダイオード249には前記バイアス電流のみ流れており図18の特性からも解るようにレーザーダイオードは発光しない。レーザーダイオードのモニター用フォトダイオード260にはレーザーが発光していないため、モニター電流Isは0となっており、オペアンプ232の出力はOVが出力されているためコンパレータ234の出力はLOWレベルとなりトランジスタ235はOFF状態となる。トランジスタ235がOFFのため前記コンデンサC07は抵抗R39, R40を通じてチャージされる。このチャージされるとき抵抗R39, R40, コンデンサC07の時定数は20~50msec程度に選ぶ。この値が非常に小さいと安定化回路の応答性が早すぎ、レーザーの光出力レベルの変動が大きくなる。またあまり大きいと応答性が悪くなり光出力が安定するのに時間がかかってしまう。前記コンデンサC07にチャージが行われることによりボルテージフォロワ237の出力電圧も徐々に上昇する。従ってレーザー変調用トランジスタ257のベース電圧が上昇するのに応じてコレクタに電流が流れる。この時のトランジスタ257のコレクタ電流Icは $\{V_B - V_{BE}(SAT)\} / R_{50}$ の電流値となる。レーザーダイオード259には前記トランジスタ258からのバイアス電流IFBと前記トランジスタ257からの電流Icとの加算電流IFが流れる。そして電流Icが増加し、レーザーダイオード259のフォワード電流IFが約50mA(TC=25℃)に達するとレーザーダイオード259は発光する。レーザーダイオード259が発光することにより前記モニター用フォトダイオード260のモニター電流が発光した光出力に応じて流れることによりオペアンプ232の+入力端子電圧が上昇し、その出力電圧も入力電圧を増幅した値が

出力される。そしてオペアンプ232の増幅度はレーザーダイオード259の出力1mwに対しオペアンプ232の出力電圧が約0.5Vになるよう予めボリュームVR01によって調整されているのでレーザーダイオード259の光出力が増加し、およそ2mw, オペアンプ232の出力電圧で約1Vになるとコンパレータ238の出力信号すなわちレーザーレディ信号S43がLOWからHIGHレベルに変化する。そしてコンパレータ234の+側入力端子にはメイン露光設定信号S44がLOWレベルのためアナログスイッチ241を通してシャドウ露光レベル(光出力P(SH))電圧が印加されている。この電圧は感光体301の感度特性に応じてシャドウ露光レベル電圧は、操作部内のシャドウ露光設定ボリューム361によって設定されている。今、平均的な値である光出力4mwに相当する電圧2.0Vであるとする。従ってレーザーダイオード259の光出力が上昇しコンパレータ234の+入力端子電圧が2.0V以上になるとトランジスタ235はONになり、コンデンサC07は抵抗R40を通してデイスチャージされる。よってレーザー変調用トランジスタ257のベース電圧も下降しレーザーダイオード259の光出力は4mw以下になる。レーザーダイオード259の光出力が4mw以下になるとコンパレータ234の+側入力端子電圧も2.0V以下になり、再びトランジスタ235がOFFする。そして、再びコンデンサC07は抵抗R39, R40を通してチャージアップされる。そうするとレーザーダイオード259は再び光出力を4mw付近を中心に変動することによりコンパレータ234はON/OFFの動作を一定周期で繰返す。尚、このコンパレータ234はヒステリシス特性を有しているため比較判断が安定化し、確実な判断を行うことができる。そして、前記抵抗R39及びR40による積分効果によりコンデンサC07の両端電圧は図20のVO1の値に近づき安定する。そして前記レーザーレディ信号S43がHIGHレベルになった後マイクロプロセッサ101は出力ポートを通して所定時間t6経過後、シャドウレベルのサンプルストロブ信号S46を出力する。サンプルストロブ信号が出力されるとサンプルホールドIC245は、ANALOG-INPUT入力端子に入力されているコンデンサC07の電圧VO1(図20)をサンプルホールドし、ホールド用コンデンサC08にその電圧を記憶する。従って、サンプルストロブ信号がOFFされた後サンプルホールドICの出力OUTには、前記シャドウレベルP(SH)を出力させるための制御電圧VO1が出力され続ける。

【0094】次にシャドウレベルP(SH)のサンプルホールド動作が終了すると、マイクロプロセッサ101は出力ポートを通してメイン露光設定信号S44をHIGHレベルに切換える。従ってコンパレータ234の+側入力端子にはアナログスイッチ240を通してボルテ

ージフォロア239の出力電圧が印加される。ボルテージフォロア239の出力にはメイン露光レベル（光出力P（ON））電圧が出力されている。この電圧は感光体301の感度特性に応じて操作部内のメイン露光設定ボリューム360によって設定されている電圧で、今は平均的な値である光出力6mwに相当する電圧3.0Vが出力されているものとする。従ってコンパレータ234の出力は一側入力端子が3.0Vに切換わったことによりLOWレベルになりトランジスタ235はOFF状態になる。よってコンデンサC07はさらにチャージアップされることによりレーザー変調用トランジスタのベース電圧も上昇しレーザーダイオード259の光出力も増加する。そしてレーザーダイオード259の光出力が6mw付近になると、オペアンプ232の出力電圧V232は約3Vになる。オペアンプ232の出力電圧が3V以上になると前述のシャドウレベル設定時と同様コンパレータ234の出力はHIGHに変化しトランジスタ235がONになり、コンデンサC07は抵抗R40を通してデイスチャージされる。よってレーザー変調用トランジスタ257のベース電圧も下降しレーザーダイオード259の光出力は6mw以下になる。レーザーダイオード259の光出力が6mw以下になると、コンパレータ234の+側入力端子電圧も3.0V以下になり、再びトランジスタ235がOFFする。そして、再びコンデンサC07は抵抗R39、R40を通してチャージアップされ、レーザーダイオード259の光出力は6mw以上になる。この様にレーザーダイオード259の光出力が6mw付近を中心にコンパレータ234はON/OFFの動作を一定周期で繰返す。そして、前記抵抗R39及びR40による積分効果によりコンデンサC07の電圧は図20V02に近づき安定する。そして前記メイン露光レベルの設定が終了すると、マイクロプロセッサ101は、後述するサンプリングタイマーの動作を開始させ印字データの感光体301への書き込み動作を行う。サンプリングタイマーは後述するレーザービーム検出信号が来るたびに一定の周期Tで次々にトリガーされ、前記印字データの書き込み動作以外の部分すなわち図20aの区間のみサンプリング信号S45を出力する。そして印字データS47及びシャドウデータS48の区間ではサンプル信号S45はLOWレベルとなっているのでアナログスイッチ236はOFFする。従って印字データD47及びシャドウ信号S48によってレーザーダイオード259は変調される印字領域ではレーザーダイオード259の光出力のレベルは、前述した様にP（ON）、P（SH）、P（OFF）の3つのレベルとなる。すなわち第1は印字データ信号S47がOFF、すなわちLOWレベルでシャドウ信号がOFFすなわちLOWレベルの場合（印字のアウトプットとしては白）でNANDゲート246が成立しアナログスイッチ254のみがONとなり、変調用トランジスタ257のベースにはメイン

露光レベル電圧V02が印加され、レーザーダイオード259の光出力はP（ON）=6mwとなる。第2は印字データ信号S47がOFF、シャドウ信号がONの場合（印字のアウトプットとしてはハーフトーン）でNANDゲート247が成立し、アナログスイッチ255のみがONとなり、変調用トランジスタ257のベースには前記サンプルホールドIC245の出力電圧V01が印加され、レーザーダイオード259の光出力はP（SH）=4mwとなる。第3は印字データ信号S47がON、シャドウ信号がOFFの場合（印字のアウトプットとしては黒）で、ORゲート248が成立しアナログスイッチ256のみがONとなる。従って変調用トランジスタ257のベースはGNDにショートされOVとなるためレーザーダイオード259の光出力はP（OFF）=0となり発光しない。この様にして第1回目の印字が行われる。そして印字が終了するとマイクロプロセッサ101は出力ポートを通してメイン露光設定信号S44を再びLOWレベルにし、シャドウ露光レベルP（SH）の再設定を行う。従ってコンパレータ234の一側入力端子の電圧は、シャドウ露光レベルの設定電圧である2.0Vになる。よってトランジスタ235はONとなりコンデンサC07はデイスチャージされVCO7は小さくなってゆく。ここでレーザーダイオードの光出力安定化動作を説明する上で第2回目の印字動作のときには仮にレーザーダイオード344のケース温度が $\Delta T$ だけ上昇したものとする。図18の特性図からも明らかに、ケース温度が上昇するとレーザーダイオードのIF-P特性曲線は右側にシフトし、同一の電流をレーザーダイオード259に流した場合、光出力Pは減少してしまう。従って同一の光出力を得るためにはIFを特性曲線が右側にシフトした分の電流 $\Delta IF$ だけ増加させなければならない。よってコンデンサC07の電圧VCO7は1回目の設定電圧V01よりも前記 $\Delta IF$ に相当する電圧 $\Delta V1$ だけ高いV03に設定されてゆきレーザーダイオード259の光出力は第1回目設定と同じP（SH）=4mwに設定される。そして第1回目と同様にサンプルストロブ信号S46によりサンプルホールドIC245に前記シャドウ露光レベルP（ON）の設定が行われる。このときもレーザーダイオード344のケース温度上昇に対応した動作となり、コンデンサC07の電圧は温度上昇による補正電圧 $\Delta V2$ だけ高いV04に設定され、そして設定後第2回目の印字が行われる。このようにしてシャドウ露光レベルP（SH）及びメイン露光レベルP（ON）は安定化回路の働きにより非常に正確に一定のレベルに保持されることにより、高品質の印字を行うことができる。尚、メイン露光レベルP（ON）は前述したように印字データ書込中を除いて常に光出力を一定に保つよう、光量安定化動作を行わせている。またシャドウ露光レベルについては各印字の印字開始前に、サンプルホールド動作を行わせてやり、メ



イン露光レベルのように印字書込動作中の光量安定化動作は行わせていない。これは回路が複雑になり高価になるのとメイン露光レベルの変動に比べてシャドウレベルは補助的なものであり多少変動しても印字品質にはそれほど影響を与えないためである。尚、感光体201の感度特性に応じてコンパレータ234に inputs する設定電圧を可変する場合には、前記メイン露光設定ボリューム360を可変して調整する。このメイン露光設定ボリューム360は、ボルテージフォロア239の入力電圧を可変するようになっている。従って、このメイン露光設定ボリューム360の可変によりP(ON)時の光出力設定電圧を調整できる。一方、P(SH)時の光出力設定電圧は、前記ボルテージフォロア239の出力電圧を抵抗R46とシャドウ露光設定ボリューム361とで分圧したものである。従って、前記メイン露光設定ボリューム360を調整することにより、P(ON)時、P(SH)時の光出力設定電圧が比例的に変化することになり、記録濃度と印加電圧との一定関係を保つことができる。従って、従来のようにP(ON)時、P(SH)時の設定電圧を共に可変して調整するという煩雑な操作を要せず調整が簡易となる。

【0095】図21は図13におけるビーム検出回路121とビーム検出器346の詳細回路図である。図21において346はビーム検出器であり応答性の非常に速いPINダイオードを使用している。またこのビーム検出器346は図3に示すように感光体301へ印字データを書込む時の基準パルスとなるものでそのパルス幅及びパルスの発生位置は非常に正確なものでなければならない。従ってパルス幅及びパルスの発生位置等がポリゴンミラー313の回転によるビーム走査ごとに変動すると感光体301上の書込み開始点の変動でしまい印字品質が悪くなる。ビーム検出器346のアノード側は負荷抵抗R52と抵抗R55を通して比較手段である高速コンパレータ262の-側入力端子に接続されている。またコンパレータ262の+側入力端子には抵抗R53とR54で分圧された電圧が抵抗R56を通して印加されている。また抵抗R54には並列にノイズ除去用のコンデンサC12が接続されている。またR57はヒステリシス特性を持たせるためのポジティブフィードバック用抵抗、C13は高速でフィードバックをかけ出力波形を改善させるためのフィードバック用コンデンサである。またコンパレータ262の+側入力には、ダイオードD40、抵抗R57を通してスレッショールド可変電圧S50が印加される。このスレッショールド可変電圧S50は、前記アナログスイッチ240又はアナログスイッチ241の出力(光出力設定手段の出力)である(図17参照)。図22にコンパレータ262の-側端子入力波形すなわちビーム検出器346の出力波形とコンパレータ262の+側端子電圧との関係及びその時のコンパレータ262の出力波形との関係を示す。レー

ザービームが高速でビーム検出器346上を通過するとビーム検出器(PINダイオード)よりパルス電流が流れコンパレータ262の-側入力端子には図22のa、bの波形が入力される。今コンパレータ262の+側入力端子の電圧がスレッショールド可変電圧S50が印加されていないため常に低い電圧V06が印加されていたとすると、コンパレータ262の出力波形は波形aの場合は点線に示すような出力波形となり、波形bの場合は実線で示す出力波形となる。ここで波形aは感光体301の感度が低い場合で前記メイン露光時のレーザー出力が6mw以上のとき波形bは逆に感光体の感度が高い場合でレーザー出力が6mw以下の時を示す。この出力波形からも解るようにコンパレータ262の+側電圧を一定にした場合出力波形はビーム検出器346に入射される光量により大幅に変化してしまう。そこで、スレッショールド可変電圧S50を使用してレーザービームの光量が大きい場合はV05の電圧に小さい場合はV06の電圧になるように補正してやることにより、図22に示すように出力波形をほぼ一定に保つことができるのである。

【0096】図23は前記ビーム検出器(PINダイオード)346の構成図である。図23において410は受光素子、411は電極線、412はマスク板、413はレーザー走査ビーム、414は受光素子取付ベース、415は出力リード線をそれぞれ示す。本実施例に使用しているPINダイオードは受光素子形状2.5×2.5mm、応答時間4nsecのものである。レーザービーム413はポリゴンミラー313の回転により一定の速度で図23の矢印方向に走査されている。そして前記レーザービーム413が前記受光素子410上を通過するとそのレーザービーム413の光出力に応じて出力電流が流れる。このとき図21のコンパレータ262の-側入力端子の入力波形は図24に示す波形となる。図24で入力波形1は前記受光素子410上にマスクがない場合の波形で出力波形の前後にノイズが発生している。これは受光素子410自体が本来静止している光の検出又は走査されている場合でも非常に遅い速度の光の検出に使用される場合を主に目的としており受光素子410の端面の平行度が悪い素子がかかなり多く、その端面を前記レーザービームが通過した場合出力電流が不安定になり発生するものである。従ってこれらの不具合を解決するため前記受光素子410の受光面上にレーザービーム413を通過させないマスク412を取付けることにより前記端面上でのビーム通過時の出力波形割れを防止している。前記マスク412は図23に示すように受光素子410の端面部分及び電極線411引出し部分を含まない部分に4角の窓をあけた構造にし前記レーザービーム413はその4角の窓の部分を通しているときのみ前記受光素子410に光が当たるようにしている。このような構造にすることにより前記マスクの窓部分の精

度特に平行度を高めることによって前記コンパレータ262への入力波形は図24の入力波形2のようにノイズを含まない波形が得られる。

【0097】図25は、図13における印字データ書込制御回路119の詳細回路図である。この印字データ書込制御回路119の主な機能としてはインターフェイス回路122からの印字データS57を印字させる用紙のサイズに合わせて所定の感光体301上のエリアに書込むべく前記パラレルな印字データS57をシリアル変換し、レーザ変調回路120に送出する。また前記印字データS57のデータ内容から印字品質を向上させるためのシャドウ信号をジェネレーションし、印字データと共にレーザ変調回路120に送出する。またレーザ変調回路120で光出力設定時に必要な信号を送出する。またインターフェイス回路122に対しては印字データ制御部2からの送出を制御するためのタイミング信号を送出する。もう一つは、メンテナンスに必要なテスト印字のパターンをジェネレーションする。

【0098】図25において186は、レーザ変調回路120及び印字データ書込制御回路119内での制御に必要な信号の送出、受信等を行うための入出力ポート、187、188は印字データの書込位置の制御、テストパターン発生、レーザ光出力サンプリング等の制御を行うカウンタ／タイマーである。189は水晶発振子で画像クロックパルスの基準クロックとなり発振周波数は約32MHzである。190は画像クロックを発生する回路でレーザビームの最小変調単位1ドットに相当するパルス(約8MHz)を発生させる。191はインターフェイス回路より受取るバイト単位(8ビット)の印字データをシリアル変換するための制御カウンタ、192はメンテナンス時使用するテストパターンを発生する回路、211はテストパターンデータとインターフェイス回路122よりの印字データとの選択を行うマルチプレクサ、210は前記マルチプレクサ211からの8ビットパラレルデータをシリアルに変換するシフトレジスタ、213、214は印字データを一時記憶するラインメモリーでメモリー容量は4096ビット、212は前記ラインメモリー213、214用のアドレスカウンタ、215は前記テストパターン発生回路を制御する信号を作るためのデコーダである。226、227、228は印字データ及びシャドウデータ送出タイミングを合わせるためのフリップフロップである。

【0099】ここで前記カウンタ187、188の詳細について説明する。275はライン(水平走査線)毎のレーザ光量補正用タイミングを決めるカウンタであり基準クロック信号S53に基づいてカウントが行われ、光量補正用及びラインスタート用に使われるサンプル信号S75を発生する。276は水平方向記録開始位置決め用のカウンタであり前記制御カウンタ191からのQ7出力(ビデオ1ドット単位信号)S83に基づいてカ

ウントされ水平方向記録開始位置(レフトマージン)信号S84を出力する。277は水平方向記録終了位置を決めるカウンタであり前記ビデオ8ドット単位信号S83に基づいてカウントが行われデータの書き終り位置(ライトマージン)信号S85を出力する。278は垂直方向記録開始位置決め用カウンタであり入出力ポート186から出力される用紙先端位置(ページトップ)信号S74及びフリップフロップ204のQ出力とを2入力とするゲート198の出力に基づいてカウントが行われページトップカウンタ出力S76を発生する。279は垂直方向記録終了位置決め用カウンタであり前記同様ゲート198の出力に基づいてカウントを行ない、ページエンドカウンタ信号S77を出力する。280は垂直方向テストパターン制御用カウンタであり前記フリップフロップ240のQ出力に基づいてカウントを行い、テストパターン制御信号S79を出力する。

【0100】図26は図13に於けるインターフェイス回路122の詳細回路図である。図26に於いて263はデータ制御部2からのコマンドデータ及び印字開始指令信号等の受取り、データ制御部2へのステータスデータ及び印字制御部のレディ状態信号等の送出を行う入出力ポート、264はコマンド及び印字の両データ用の8ビットラッチ、265はインターフェイスデータバスS59用のトランシーバ／レシーバである。266はデータバスS59上のデータの指定を行うデータ選択信号S60用のデコーダ、269はコマンドデータ及び印字データ受信時のデータ制御部2に対するデータ送出タイミングを制御するBUSY信号の制御回路をそれぞれ示す。

【0101】次にインターフェイス信号の詳細について説明する。図26に於いてS59は双方向性の8ビットデータバス、S60はデータバスS59上のデータ選択信号でIDCOM、IDSTAの2信号の組合せにより前記データバスS59上のデータを選択する。S61はIPRDYで印字制御部100がレディ状態であることを知らせる信号、S62はIPREQでデータ制御部2よりプリント開始信号IPRNTの送出を許可する信号、S63はIPENDでデータ制御部2側はこの信号を受取ることにより印字データの送出を停止する。S64はIHSYNで印字データ1ラインの送出要求信号、S65はIPRNTでプリント開始指令信号、S30はコマンド及び印字データのストローブ信号で略称ISTB、S66はIBSYで前記ストローブ信号S30の送出許可及びステータスデータのデータ制御部2側での読取りを許可する信号である。

【0102】コマンド及び印字データはトランシーバ／レシーバ265の出力ラインS72にステータス識別信号S68がOFFであるとき出力される。出力ラインS72上のデータはストローブ信号S30によってデータラッチ264にラッチされる。そしてコマンドデータの

場合は入出力ポート263にラッチされそのコマンドの識別を行った後コマンドの持つ規定動作を実行する。また印字データの場合は出力線S59より前記印字データ書込制御回路に送られる。またステータスのデータの送出は次の様に行われる。ステータスのリクエストコマンドを印字制御部100側で受取ることにより、そのコマンドに対応したステータス内容を入出力ポート263のステータスデータ出力S71にセットする。セットされたステータスデータS71はトランシーバ/レシーバ265に入力される。入力されたデータはステータス識別信号S68がONであるとデータバスS59上に出力する。

【0103】本印字制御部100で使用するコマンド及びステータスの詳細を図27、図28にそれぞれ示す。図27に於いてSR1~6は図28中のステータス1~6に対応するステータス要求コマンド、PSONは定着器331の消費パワーを減少させるパワーセーブコマンド、PSOFは前記パワーセーブ状態の解除コマンドであり、非記録時にはパワーセーブコマンドPSONにより定着器331の消費パワーを減少させて節電を図り、記録時にはパワーセーブ解除コマンドPSOFによりパワーを通常の値まで増加させてトナーの定着をすることができる。CSTUはカセットの上段給紙指定コマンド、CSTLは同じく下段指定コマンド、VSYNCはデータ制御部2より印字データの送出開始を指示するコマンド、MF1~9は手差しモードの指定コマンド、TBM1~4は用紙上の印字開始位置を指定するトップ/ボトムマージン指定コマンド、SOFはシャドウ露光を強制的にOFFするコマンドをそれぞれ示す。

【0104】図28に於いて紙搬送中は用紙の給紙が行われプリンター内に用紙が搬送中であることを示すステータス、セレクトスイッチONは操作部のセレクトスイッチ354が押されたことを示すステータス、VSYNCリクエストは印字制御部100がプリント開始指令を受け、印字データの受信が可能になったことを知らせるステータス、手差しは給紙モードが手差し状態であることを知らせるステータス、カセット上段/下段はカセット給紙モードに於ける選択カセットの状態を示すステータス、トップ/ボトムマージンは前記トップ/ボトムマージンコマンド(TBM1~4)で選択されているトップ/ボトムマージンの状態を示すステータス、カセットサイズ(上段)及びカセットサイズ(下段)はそれぞれ装着されているカセットのサイズコードを示すステータス、テスト/メンテナンスはテスト/メンテナンス状態であることを示すステータス、データ再送要求はジャム等によって再印字が必要な場合を示すステータス、ウェイト中はプリンターが定着器のウォームアップ状態であることを示すステータス、パワーセーブ中は前記パワーセーブコマンド(PSON)によってパワーセーブモードの状態であることを示す。オペレータコールはステータス4のオペレータコール要因が発生していることを示す。サービスマンコールはステータス5のサービスマンコール要因が発生していることを示す。トレイフルは排紙トレイに規定の枚数以上の用紙がありトレイがフル状態であることを示す。トナーバック交換はトナーバックにトナーが満杯であることを示す。紙ジャムは用紙が機体内でジャムしたことを示す。トナーなしはトナーホッパ内にトナーが無くなったことを示す。カバーオープン

はフロントのドアが閉じていないことを示す。タイミグエラーは印字データの転送に支障があったことを示す。定着器故障は定着器のヒータ断線、温度FUSE切れ等、定着器に異常があることを示す。レーザー故障はレーザーダイオードが規定の出力に達しない、あるいはビーム検出器がビームを検出できないことを示す。スキャンモータ故障はスキャンモータが起動時一定時間経過しても規定回転数に達しないあるいは規定の回転数に達した後何らかの原因で規定回転数から外れたことを示す。ヒートローラ交換は前記図15の定着器ローラカウンタが規定の値に達し定着ローラの交換が必要であることを示す。ドラム交換は同様にドラム交換カウンタが規定値に達しドラムの交換が必要な場合、現像剤交換は同様に現像剤交換カウンタが規定値に達し現像剤の交換が必要な場合であることをそれぞれ示す。

【0105】図29は図3に於ける感光体301上のビーム走査部349を含んだレーザービームの1回の走査範囲とその走査範囲内に入るビーム検出位置及びデータの書込位置等の位置関係を表わした図である。図29に於いて416はビーム走査開始点、417はビーム走査終了点でありビーム走査終了点417に達したビームはポリゴンミラー313の次の面により時間0でビーム走査開始点416より次のビーム走査を開始する。418はビーム検出器346のビーム検出開始点を示し、428は感光ドラムの左端面、429は同じく右端面をそれぞれ示す。419は用紙サイズA3の用紙左端面、420は同じく右端面を表わす。421は用紙サイズA3の用紙左端面、420は同じく右端面を表わす。421は同じくA3サイズの用紙のデータ書込開始点、422は同じくデータ書込終了点を示す。

【0106】423は用紙サイズA6の用紙左端面、424は同じく右端面、425は同サイズのデータ書込開始点、426は同じくデータ書込終了点をそれぞれ表わす。また427は用紙の中心点を表わす。

【0107】d4はビーム走査418よりA3サイズ書込開始点までの距離、d5は同じくA6サイズ書込開始点までの距離、d6は同じくA6サイズの書込終了点426までの距離、d7はA3サイズの書込終了点までの距離をそれぞれ表す。d8はビーム検出点418よりA3サイズで用紙右端面420までの距離を表す。またd3はビームの一走査の範囲を表す。d14、d9、d10はそれぞれA3及びA6における有効印字範囲を示

す。本図からも明らかなように本プリンターの用紙送りは常に用紙中心点427を中心に送るため各紙サイズによってビーム検出器位置418からの印字書込開始点が異なっており、従って紙サイズに合せてビーム検出器346がビームを検出してから各書込開始点までの距離に相応して時間経過後データの書込を行う必要がある。このような制御を行うかわり、本プリンターは用紙の耳送り機構を採用していないため、用紙全面に印字することが可能である。本実施例では用紙左右のレフト及びライ

トマージンを3mmに設定しているがこれを0にすることは可能である。また従来の耳送り搬送を行うプリンターについては通常8～10mm程度のマージンが必要となり、用紙上のかかなり大きな部分が印字できなくなるという欠点がある。

【0108】図30は、図29の用紙サイズ及び印字エリア部分を水平方向のみでなく用紙全面を表したものである。図30において、436はA6用紙、437はA3用紙を表す。419、420、421、422、423、424、425、426、427については図29と同様の位置を示す。430は用紙の先端、432は用紙垂直方向のデータ書込み開始点、431はA3サイズ

の用紙後端、433はA3サイズのデータ書込み終了点を表す。434はA6サイズの用紙後端、435はA6サイズのデータ書込み終了点を表す。

【0109】次に図31、図32のタイムチャートをも参照して前記構成装置の作用を説明する。

【0110】印字制御部100のレディ信号IPRDY O (S61) がプリント (印字) 可能な状態になる。同時にプリント開始信号IPREQ O (S62) が能動状態になる。次にレーザーイネーブル信号LDON1 (S49) が“1”に立上る。この信号S49により図17のトランジスタ258をオンさせる。このとき、図25のデータ用フリップフロップ226～228はセットされておらず、従って印字データ信号S47及びシャドウ信号S48は共に“0”になっている。レーザーイネーブルS49が“1”、印字データが“0”、シャドウ信号S48が“0”であるため図17のゲート246が成立し、アナログスイッチ254がオンになるためこれによりレーザーダイオード259が発光する。するとモニター用フォトダイオード260が動作し、オペアンプ232を介してオペアンプ239が動作し、レーザーレディ信号LRDY1 (S43) が発生する。次に水平同期信号HSYO (S54) に同期してカウンタ275からサンプル信号SMPTO (S75) が発生する。この信号S75は用紙サイズを規定する図29における416～417の間の距離d3 (1ラインの距離) に相当する時間をセットするように利用される。これによってライン毎に光量補正を行ったり、ラインスタート信号として利用したりする。即ち、この信号S75によって図25のゲート193が開き、ゲート194からサンプル信号

S45が発生し、このサンプル信号S45が図17のゲート244を介してアナログスイッチ236をオンさせるので、補正用信号がレーザーダイオード259に与えられることになり、こうしてライン毎の光量補正が行われる。PTCTO (S76) は用紙の先端を決めているカウンタ (ページトップカウンタ) の出力信号、PECTO (S77) は用紙の終了位置を決めているカウンタ (ページエンドカウンタ) の出力信号である。画像が書込めるタイミングになった時、VSYNCリクエストのステータスを外部装置に送る。これによりVSYNCコマンドが出て、それを受け取るとPTOP (S73) が出てその点からHSYNCのライン数を数え始める。同様にしてその位置から何目迄書くか (終了位置) を指定する。この指定値を変更できるようにするためトップマージンnT及びボトムマージンnEが設けられている。前述のような指定が行われると、VSYNCが来たときに用紙先端の手前でPTOP信号が出力される。例えば5mmの余白が必要であればそれを含めたライン数をカウントする。仮にトップの値が10mmとすればその分に対応するデータをタイマーにセットすることになる。同様にしてボトムの位置も決められる。タイマーにデータがセットされるとそこからゲートを開いてカウントを行い、カウント終了で立上る。このようにどこからどこ迄を書くかを決めているのが図25のゲート201である。LSTO (S78) は同期をとるためのフリップフロップ204のQ出力でありHSYNCによってセットされ、サンプルタイマー信号が立上った時にリセットされる。このリセットラインは図25のLDON信号 (S49) に入っていてリセットラインは通常は働かないで強制的にリセットがかけられるようになっている。リセットによりフリップフロップ204のQ出力が発生し、クロック発生回路190が働き発振器189からのクロックを数える。このクロック発生回路190は発振器189からのクロックを4分周し、ビット単位の信号をラインスタート信号LSTがセットされている間だけ出力する。この出力は位相を異ならせて2種類の信号S82とS87になっている。これによって一ライン分の同期がとられる。VDAT1は印字データ信号 (S47) で、P/S変換シフトレジスタ210の動作によってシリアルデータとして出力される。即ち、P/S変換シフトレジスタ210はクロック発生回路190からの信号S82によって動作するが、ロード信号が印加されない時は出力S86は“0”となっており、(レーザー書込なし)、ロード信号S88が入ったときにデータD5～D12をシリアル変換して出力する。このとき、ゲート207～209によって8ビットに1回の周期でロードされることになる。ここでロード信号の発生タイミングについて説明する。実際に書き込みたい場所があるとき、用紙サイズが変わる毎にデータをセットすることになるが、これを制御するカウンタが図25のレフトマー

ジンカウンタ276（データは図29のd9, d10）とライトマージンカウンタ277（データは図29のd11, d12）である。この場合のセットは用紙の中央を基準にしてレフトとライトの距離を規定するものである。HSYNC信号に同期してLST信号（S78）が出るとフリップフロップ196がセットされ、これによりゲート198が開らぎ、カウンタ276がカウントを開始する。この場合のカウントはビデオクロックを1ビット毎にカウントするのではなく、8ビットに1回づつカウントすることになる。8ビット毎に出てくるカウン  
10 ント出力をレフトマージンNLm、ライトマージンNRmに合せてセットするとLST信号（S78）に同期したカウントが行われる。そして、設定してカウント数を出力すると立上がる。従ってゲート201が縦方向を決めており、ゲート199が横方向を決めていることになり両ゲート出力が（1, 1）になったときのポイントに書き込むことになる。このタイミングで前記ロード信号が出力されシフトレジスタ210からデータS86をシリアル変換して送出する。

【0111】ラインメモリアウト信号LMOT（S80）はORゲート222の出力である。これはラインメモリ213と214のいずれのデータを送出するかを制御するものである。即ち、この送出タイミングはフリップフロップ203によって制御される。即ち、このフリップフロップ203はクロックパルスが印加される毎に出力状態が変わることになりゲート220と221を交互に開くことになるのでこれによりラインメモリ213又は214の出力DOUが交互に読み出される。ラインメモリ213, 214への書き込みタイミングもゲート217, 218が交互に開くことになり制御される。こ  
30 のようにしているのは後述のシャドウ方式を採用する場合にデータの書き込みと読み出しを同時に行えるようにして処理の円滑化を図るためである。

【0112】次にLDAON1（S81）について図43をも参照して説明する。

【0113】この種の記録装置にあっては通常感光体301の軸方向全面に亘ってレーザーが放射されていない場合、例えば小サイズ用の紙（図43に示す用紙458の如きB5やA4等）にしか印字しない場合が多く、このため使用に供されない両端部間近傍の部分にはトナー等  
40 が付着しなくなってしまう。また、大きなサイズの用紙（例えば図43の用紙461）であっても、未使用領域が存在する（小サイズの用紙458についても使用領域は斜線部459内である）。このように長時間トナーが付着しない領域を設けると記録終了後ブレードによって付着トナーをかき落す段階で、未付着部分でのブレードの接触抵抗が大となり感光体表面にキズを付けてしまうという問題がある。そこで本装置では、図31のタイムチャートに示すように、1枚の用紙相当分の印字が終った直後にラインデータオン信号LDAON1（S81）  
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を発生させ、この発生期間内に印字データ信号VDAT1（S47）を強制的に与えるようにし、この動作によって図43に示すような感光体の軸方向全面に亘るライン（像）460及び463を1枚の用紙相当分の印字終了後に書くようにして前記欠点を除去している。この場合、ラインデータ書き込みのタイミングはラインメモリアウト信号LMOT1（S80）のデータにおける最終段階データLDATnの1つ手前のデータLDATn-1の立下り時から所定時間txが経過したときに発生させるようにしている。尚、このようなラインは必ずしも各用紙相当分の印字が行われた後に定期的を書くものに  
限らず、ロット単位（例えば10枚毎とか100枚毎）毎に書くよう設定してもよい。

【0114】次に図33乃至図36をも参照して印字する文字に「影」（シャドウ）を付することによって文字等を見やすくするために使われている方式（シャドウ方式ともいう）について詳述する。

【0115】シャドウ信号S48を発生するか否かの判別は前記ラインメモリ213, 214のデータを交互に入力する各種ゲート220乃至225と、3個のフリップフロップ226～228及びその出力側のゲート231によって行われる。そのうち、フリップフロップ227は横方向（ライン方向）のレベルの変化に基づくシャドウの判別に、フリップフロップ228は縦方向（垂直方向）のレベルの変化に基づくシャドウの判別に寄与することになる。即ち、ラインメモリ213からこれから書き込もうとするシリアルデータが読み出されてこれがフリップフロップ226をセットしたとすると、前のライン方向のデータがフリップフロップ227に入っている  
30 のので、例えば現在のデータが“0”で前のデータが“1”の状態のときにシャドウ信号S48が出力される。同様に前のラインのデータと現在のラインのデータとがゲート223で比較され、例えば現ラインのデータが“0”前のラインの同一水平方向位置におけるデータが“1”のときにフリップフロップがセットされシャドウ信号が生ずる。尚、両フリップフロップ227, 228がセットされたときもシャドウ信号が生ずる。この状態を図32のシャドウアウト信号SOUT1（S86）、印字データ信号VDAT1（S47）、シャドウ信号SDAT1（S48）として示している。

【0116】図33は前記シャドウ方式を用いない場合の従来の現像パターンを示すものであり、図34は前記シャドウ方式を用いた場合の現像パターンを示すものである。このように、「謹」の文字を印字したとき図32にはシャドウ（影）が付されるので非常に見易くなる。

【0117】図36は縦線S1と横線S2と交差させ、図示右上領域に露光位置と露光エネルギーの関係を示す特性図PAT1, PAT2を、図示左上領域に感光体の表面電位と露光エネルギーの関係を示す特性図Q、図示  
左下領域に露光位置と表面電位との関係を示す特性図R

1, R 2をそれぞれ示したものである。この図では図3 3及び図3 4における文字の中でX方向「8」でY方向「1 4~2 1」を抽出したものである。同図に示すように図3 3に示すパターンの特性PAT 1及びR 1と図3 4に示すパターンの特性PAT 2及びR 2は異なったものとなっている。特に、現像特性にあってはある現像レベルLにおいて、図3 6の特性図R 1の幅D 1よりも図3 4の特性図R 2の幅D 2の方が大きくなっていることが分る。尚、図3 5は露光位置と露光エネルギーとの関係を示す特性図であり、レーザー照射時P (ON) のエネルギーは例えば6 mw, シャドウ部分作成時P (SH) のエネルギーは例えば4mwとしている。

【0 1 1 8】以上のシャドウ方式をまとめると次のようになる。

【0 1 1 9】ビーム走査により記録感光体上に記録情報（文字情報等）を、ビーム強度相違に対応して記録するものにおいて、シリアルな2値の入力データを第1と第2の強度を有するビーム（前記P (ON) 及びP (OFF)）に基づいて記録を行うと共に、前記入力データが特定の関係にあるときは、前記第1又は第2の強度のビームに置き換えて第1又は第2の強度中間に位置する第3の強度（ハーフトーン）のビームにより記録を行うものであり、この特定の関係の判別は、例えばビーム走査が水平ライン毎に順次行われるものであるとき、（a）水平ラインにおける2値データが有意的記録データ（文字を形成するためのデータ）から無意的記録データ（文字形成に寄与しないデータに）に変化することを判別し、その変化直後の無意的記録データ部分を第3の強度のビームで走査すること及び（b）水平ラインにおける現在のラインのデータとその位置に相当する垂直方向の

40 前回のラインのデータとを比較し、前記（a）と同様に有意的記録データから無意的記録データに変化するとき変化直後の無意的記録部分を第3の強度のビームで走査することである。

【0 1 2 0】尚、前記シャドウを付する場合、記録情報の種類（例えば文字情報と画像情報）に関係なく採用してもよいが、文字情報を取扱うときにだけこの方式を使用することが好ましい。この場合は図5 5のフローチャートに示すように、マイクロプロセッサで「シャドウ」のフローか否かが判断され、文字情報であれば「シャドウ」ONのフローに移行し、文字情報以外のもの（例えば画像情報）であれば「シャドウ」を動作させないようにして自動的に行わせるようにしている。この場合のコマンドは図2 7に示す「SONFシャドウON/OFF」である。あるいはパネル部分に「シャドウON/OFF」スイッチを設けてオペレータが任意に選択できるようにしてもよい。

【0 1 2 1】以上のようなシャドウ方式を用いれば、記録情報が文字情報である場合には「影」を付すことができるので印字品質を高めることができる。特に高密度ビ

ーム記録時における従来の2値ビーム強度による記録方式の欠点であった1ドットラインの印字濃度低下によるラインの「かすれ」を防止でき、この結果1ドットラインの印字濃度が高くなるため、40×40ドット構成等の高ドットの漢字フォントに対してもその印字品質を高めることができる。また、ポリゴンミラーの「面振れ」による感光体上でのビームの垂直方向の振れの許容範囲を広げることができるためポリゴンミラーの加工がし易くなり、安価になるという利点もある。

10 【0 1 2 2】尚、文字情報以外にも単純な図形情報の場合にも前記シャドウを施すようにしてもよい。

【0 1 2 3】次に帯電補正について図3 7乃至図4 1及び図5 9のフローチャートをも参照して説明する。

【0 1 2 4】図3 7は前記帯電用高圧電源回路1 6 0内の一構成例を示すものであり、これは高圧電源ON/OFF信号S 3 5によって動作制御が行われる電圧制御回路4 4 5と、この電圧制御回路4 4 5によって1次側に周波数出力が印加され、2次側から高圧出力を発生する昇圧トランス4 4 6と、昇圧トランス4 4 6の出力を整流して整流出力を前記帯電チャージャ3 0 4に印加する高圧整流回路4 4 7と、帯電チャージャ3 0 4に流れる電流を人力しそれを電圧に変換する電流／電圧変換回路4 5 0と、この電流／電圧変換回路4 5 0の出力を一方の入力とし、制御基準電圧発生回路4 4 8の出力を他方の入力とするオペアンプ4 4 9とによって構成されている。前記制御基準電圧発生回路4 4 8はアナログ制御信号S 3 6によって制御され異なる制御基準電圧を出力するようになっている。このような構成によれば、制御基準電圧発生回路4 4 8からの出力に基づき電圧制御回路4 4 5の出力周波数が決められ、これに基づいて高圧出力が発生すると共に、このときの帯電用チャージャの電流を電流／電圧変換回路4 5 0に印加し、この出力電圧と基準電圧とをオペアンプ4 4 9で比較し、両者が一致するように制御動作が行われるので出力印加電圧の安定化が図れる。

【0 1 2 5】ここで、アナログ制御信号S 3 6の内容につき詳細に説明する。

【0 1 2 6】感光体3 0 1は図3 8に示すように温度変化によって表面電位が大幅に変化する特性を有する。同図では横軸に温度を示し縦軸に表面電位変化量 $\Delta V O$ を示したものでありドラムの種類4 5 1, 4 5 2, 4 5 3によってそれぞれ特性が異なっている。また、図3 9は温度2 5℃のときの各ドラム4 5 1, 4 5 2, 4 5 3のドラム流入電流I Dと表面電位V Oとの関係を示す特性図を示すものであり比例直線となっている。従って表面電位を一定に保つためにはドラム流入電流I Dを変化させればよいことになる。例えば図3 9における特性4 5 1のドラムについては8 0 0 Vの表面電位を保つためには表面電位変化量 $\Delta V O$ に対応する流入電流変化量 $\Delta I D$ 分だけ減算し、特性4 5 3のドラムについては表面電

位 $\Delta V_O'$  0に相当する流入電流変化量 $\Delta I_D'$  だけ増加させればよいことが分る(前記感光体の各種特性データは前記RAM107に入っている)。ここで流入電流 $I_D$ と出力電流とは図40に示すように対応関係にあるから前記帯電用高圧電源回路160内の制御基準電圧発生回路44へのアナログ信号(入力電圧)S36を2V、4V、6Vと変化させてやることによって上記流入電流 $I_D$ を調整することができる。図41は、アナログ入力電流(図15のD/Aコンバータ165の出力電圧と温度との関係を示すものであり、例えばドラム301の温度を前記温度センサ342(図14のサーミスタ)で検知し、温度変化に対応して前記アナログ制御信号S36を印加してやればよい。

【0127】以上のごとき内容に基づいて前記帯電補正が行われるわけであるがその動作を図56を基に説明する。図14に示したサーミスタ342がドラムの温度を検知すると、A/Dコンバータ271がデジタル信号に変換し、データ変換が完了すると温度データDTnと温度25℃のときのドラムの温度データDT25とを減算した値 $\Delta T$ を読取る。次に温度25℃時の基準データDV25を読取り、 $DV25 + \Delta T$ の演算を行い、その算出結果DVnをD/Aコンバータ165へ出力する。そして図45に示したアドレス「6000」のドラム特性データをRAM107を参照してドラム特性NOを識別し、更にフィードバック誤差データ $\Delta V$ を読取る。次に温度25℃時の基準データDV25を読取り、 $DV25 + \Delta V$ の演算を行い、その演算結果DVnをD/Aコンバータ165へ出力する。そして帯電用高圧電源160のアナログ入力にVnを印加する(S36)と共に帯電用高圧電源160の制御入力信号S35をON状態にして補正を行う。温度が変化する毎に上記補正が繰り返されてドラムの表面電位を一定に保つようになっている。

【0128】尚、不揮発性RAM107に記憶されている各種感光体(ドラム)の特性に関してはオペレータが外部から指定できるようにしている。即ち、図63のフロー図(丸枠Cで示す。)に示すように、ドラム交換か否かの判別が行われたとき、ドラム交換であればドラム特性NOをセットすることによりテストキーをONにした後不揮発性RAM107のドラム特性NOエリアにドラム特性NOの書き込みが行われる。従って、その後は常に現在使われているドラムの特性が選択され、これに基づいて補正が行われる。

【0129】以上のような帯電補正が行われると、外部環境変化及び気体内の温度上昇により感光体の温度が変化しても感光体の帯電電位は一定に保たれるので、温度変化に基づく帯電電位の低下、印字濃度の低下あるいは帯電電位上昇によるかぶり等の不具合の発生を防止でき、常に鮮明な印字を提供できる。また、この実施例では感光体の温度特性を分類した情報をインプット(外部

設定)することにより、それに応じた補正が行われるため、きわめて高い精度で帯電特性の温度補正を行うことができる。従って、感光体自体の温度特性のバラツキをも緩和できることになり、感光体の仕様の範囲を広げることができるという利点もある。

【0130】次に図47乃至図59のフローチャート及び図60乃至図62のタイムチャートをも参照して本装置全体の動作を説明する。

【0131】電源ONの後にドアスイッチ129がOFF、排紙スイッチ336がOFF、マニュアルストップスイッチ328がOFF、パスセンサー123がOFF、温度フューズ130が断となっていないこと、排紙トレイ384が満杯(FULL)でないか否かが確認され、更にテストプリントモードか、メンテナンスモードか、交換モードかが確認される。それぞれが問題なければMCリレー131がONになり、定着器ヒーターランプ333がON、スキャンモータ312がONとなりタイマーA(TIMA)がスタートする。タイマーATIMAが所定時間t1をカウントすると、ドラムモータ、現像器モータ等の機構部がONとなり、次にTIMAが所定時間t2をカウントするとレーザー344がONになる。TIMAにより時間t25がカウントされるとレーザーレディか否かが判別され、イエス(Y)であれば次にTIMA=t26が計時され転写チャージャ、レーザー、現像器モータ、現像スリーブバイアスがそれぞれOFFとなり、さらにTIMA=t27の時間経過時にドラムモータ、ヒートローラモータ、除電ランプ、転写前除電ランプがOFFとなる。次にTIMA=t29のタイミングでスキャンモータレディ、HSYNCレディかが判断され、イエス(Y)であればTIMAはストップとなる(以上図47)。

【0132】次に「ステータス4中のトレイフル」の判別が行われ、「トナーバック交換」の判別、「トナーなし」か否かの判別が行われ、「トレイフル」であれば排紙トレイ内の用紙除去後「トレイフル」のフラグを“0”にし、排紙トレイカウンタをリセットし、「トナーバック交換」であればその状態が元に復帰した段階でリセットが行われ、トナー補給の場合も復帰した段階でリセットが行われる。以上のフローを通過すると次に「ステータス3」中の「パワーセーブ中」か否かが判別され、ノー(N)であれば次に「ステータス4」中の「紙なし」の判別が行われ、イエス(Y)であれば「カセット紙なし検知ON」か否かが判別され、ノー(N)であれば「紙なし」フラグを“0”にし、「定着器レディ」であれば「ステータスウエイト中」フラグ“0”にする。次にIPRDY ON、IPREQ ONとなり、「パワーセーブ中」か否か、「紙なし」か否かがそれぞれ判別され問題がなければTIMAがスタートする。TIMA=t01でレジストモータ149が逆転し、TIMA=t02でレジストモータが停止する。この段階で

紙の先端が給紙ローラに挟持されている。次に「手差し」か否かが判別され、ノー(N)であれば「IPRNT ON」か否かが判別され、イエス(Y)であれば「IPREQ OFF」となる。次にタイマーE(TIME)が動作中か否かが判別され、動作中であれば「TIME=t30」が判別され、イエス(Y)であればTIMEストップとなり転写チャージャ305、剥離(剥離)チャージャ306、現像器モータ141、定着器モータ143がそれぞれONになる。「TIME=t30」でなければTIMEはストップとなり丸枠Fのフローに移行する(以上図48)。

【0133】次にTIMAがスタートし、ブレッドソレノイド158がONになり、「TIMA=t1」で現像器モータ141、除電ランプ302、転写前除電ランプ303、ドラムモータ147それぞれがONとなる。

「TIMA=t2」で転写チャージャ305、定着器モータ143がONとなる。

【0134】「TIMA=t3」で剥離チャージャ306がONとなり、次に「TIMA=t4」のときにTIMAを“0”から再びスタートさせる。次に「手差し」か否か、カセット上段、下段が判別され、上段であれば給紙モータ151を正転させて上段給紙を行い、下段であれば「TIMA=t5」まで待ってから給紙モータ151を逆転させて下段給紙を行う。次に「TIMA=t5」のときにレーザー344をONさせ、「TIMA=t6」のときに帯電チャージャ304をONさせる。

「TIMA=t7」でレーザーレディか否かをチェックし、イエス(Y)であれば「ステータス1」中の「VSYNCRクエスト」フラグを“1”とする。その後タイマーB(TIMB)をスタートさせて丸枠Gのフローに移行する(以上図49)。

【0135】次に「TIMA=t31」で給紙モータ151を停止し、「VSYNCコマンド受取り」を判別し、イエス(Y)であれば「TIMB<t32」か否かを判別し、イエス(Y)であればTIMBをストップさせ、「ページトップ」、「ページエンドカウンタ」のカウント開始、画像書き込み処理とする。タイマーC、D(TIMC、D)をスタートさせ、「TIMA=t34」でTIMAストップ、給紙モータ151停止をする。次に「TIMC/D=t35」でレジストモータ149正転、トータルカウンタ354ONとし、「TIMC/D=t36」でトナー濃度の高低を判別する。濃度が低い場合はトナー補給モータ159をONにする。

「次にページエンド割込」が判別され、イエス(Y)であれば画像書込終了IPENDパルスを出力させる。その後各カウンタを+1とし、「トレイフル」、「ドラム交換」、「現像剤交換」、「ヒートローラ交換」であれば各状態が表示される。尚、前記「VSYNCコマンド受けとり」の判別結果が、ノー(N)であれば「TIMB=t46」で帯電チャージャ304OFF、「TIM

B=t47」でレーザー344、剥離チャージャ304OFF、「TIMB=t47」でレーザー344、剥離チャージャ306、現像器モータ141をそれぞれOFF、「TIMB=t48」で転写チャージャ305、定着器モータ143をそれぞれOFF、「TIMB=t49」でドラムモータ147、除電ランプ302、転写前除電ランプ303をそれぞれOFF、「TIMB=t50」でブレッドソレノイド158をOFFとする。又、前記「TIMB<t32」のフローで、ノー(N)であれば次に「TIMB<t33」を判別し、ノー(N)であればTIMBストップ、TIMAスタートとする。その後ブレッドソレノイド158をONにし、「TIMA=t1」の段階で現像器モータ141、ドラムモータ147、除電ランプ302、転写前除電ランプ303をそれぞれONとする。そして「TIMA=t2」のとき転写チャージャ305、定着器モータ143をONとし、「TIMA=t3」のとき剥離チャージャ306をONとする。次に「TIMA=t4」か否かの判別を行ない、タイマーAを一旦ストップさせ、再びスタートさせる。そして、現像器モータ141、転写チャージャ305、剥離チャージャ306、定着器モータ143をそれぞれONさせる。「TIMA=t5」でレーザー344ON、「TIMA=t6」で帯電チャージャ304ON、「TIMA=t7」でレーザーレディか否かの判別を行い、イエス(Y)であればTIMAをストップさせる(以上図50)。

【0136】次に「トナー満杯検出スイッチ126」ONか否かを判別し、ONであれば表示を、ONでなければ「トナーなし検出スイッチ125」ONか否かが判別され表示が行われる。次に「手差し」か否かの判別が行われ手差しでなければ次に「指定カセット紙なし」の判別が行なわれ紙がなければその旨の表示と、STPF(ストップフラグ)を“1”にする。次にタイマーE(TIME)をスタートさせる。ストップフラグが“1”であればSTPFを“0”にし、プリントレディIPRDYをOFFにする。STPF=1でないときは「手差し」か否かの判別が行われ、「手差し」であればTIMEストップ、マニュアルストップスイッチ328OFF、手差し“O”、TIMBストップ、カセット紙なし検出スイッチONか否かの判別が行なわれ、次にプリントリクエストIPREQ ONになり、前記図48の丸枠Iのフローに移行する(以上図51)。

【0137】次に前記各フロー中のタイマー割込みの内容について図52及び図53を参照して説明する。これは各タイマーA、B、C、D、Eがそれぞれ動作中か否かを判別して、それぞれが動作中のときはカウントアップを行う。ポート入力読取部分で全部の入力情報を読み取る。そして「TIMC/D=t38」でそのタイマーをストップさせ、「TIME=t39」か否かを判別し、以降はタイマーE(TIME)の動作を続行させ、



各時間毎に「トナー補給モータ159」,「レジストモータ149」を停止させる。その次に「TIME=t4」の後で「TIMA動作中」か否かを判別する(これは次の用紙のプリントが行われるかどうかを判断するためである)。TIMAが動作中であればTIMEをストップさせる。その後「TIME=t41」で帯電チャージャ304OFF,「TIME=t42」でレーザー344,剥離チャージャ306,現像器モータ141をそれぞれOFFとする。「TIME=t43」で転写チャージャ305,定着器モータ143をそれぞれOFF,「TIME=t44」でドラムモータ147,除電ランプ302,転写前除電ランプ303をそれぞれOFFにする(以上図52)。「TIME=t45」でブレードソレノイド158OFF,TIMEストップ,「定着器温度正常か」否かの判別,「定着器温度フューズ段か」,「スキャンモータ312レディか」,「ドアスイッチ129OFFか」の判別が行われ,それぞれの状態により,各種処理が行われる。

【0138】次に,前記各フロー中のコマンド割込の内容について図54を参照して説明する。コマンド割込みの処理に入ると,「バリティーエラー」か否かが判別され,エラーであれば,「ステータスDATA81」のフラグが“1”となり「不法コマンドエラー」となる。「バリティーエラー」でなければ「ステータリクエスト」がSR1~6の範囲かが判断され,範囲内のときにはそのうちのいずれかに対応した出力が発生する。「ステータスリクエスト」のいずれにも該当しないと,「トップ/ボトムマージン」か否かが判断され,そうであれば「トップ/ボトムマージン」が指定され「ステータスセット」で“1”となり,「DATA21~11」のいずれかが指定される。「トップ/ボトムマージン」でないときには「手差し指定」か否かが判断され,イエス(Y)であれば次に手差し表示,紙サイズ表示が行われ,紙サイズレジスタがセットされる。そして手差しステータスセットでステータス1となり「DATA41」フラグが“1”になり,次にステータス4で紙なしフラグが“0”となるフローに移行する。「手差し指定」でないときには「カセット指定」か否かが判断され,「カセット指定」であれば上/下段表示紙サイズ表示が行われ,紙サイズレジスタがセットされ,手差しステータスリセットとなり,ステータス1となり,DATA41フラグ“0”,カセット紙なしか否かが判断され紙なしであればフラグ“1”となる。「カセット指定」ではないときは「セレクトランプ点灯」か否かが判断され,オンラインのセレクトランプ(外部装置,例えばホスト側から指定されるもの)点灯か否かが判断され,イエス(Y)であればセレクトランプ点灯となり,セレクトランプ点灯でない場合はセレクトランプ消灯か否かが判断され,イエスであればセレクトランプ消灯となり,ノー(N)の場合は次のフローに移行する。

【0139】次に図55乃至図58に示すフローチャートを説明する。

【0140】図55には前述の「シャドウ方式」以外に「パワーセーブ」が入っており,「パワーセーブ中」であればスキャンモータ312OFF,定着器をパワーセーブ温度にコントロールし,「ステータス3のパワーセーブフラグ1」とし,パワーセーブ解除時にはスキャンモータ312ON,定着器通常温度にコントロール,「ステータス3パワーセーブ中フラグ0」とし,「画像データ転送開始」であれば図56,図57,図58のフローに移行する。

【0141】紙サイズレジスタの読取が行なわれ,指定紙サイズのトップマージンテーブルデータ(D1)の読取が行われ,トップ/ボトムマージン指定が5mmか否かが判別され,ノー(N)でトップ/ボトムマージン変更テーブルデータD2の読取りが行われる。次にトップマージンテーブルデータD1+マージン変更テーブルデータD2の演算が行われ,トップマージン調整スイッチ(図14の442)の内容が読取られる。次にスイッチに対応したトップマージン調整テーブルデータD3の読取が行われ,D1と(D1+D2)の値にマージン調整テーブルデータD3の加減算が行われ演算結果D4をページトップカウンタ278にセットする。そして指定紙サイズのボトムマージンテーブルデータD5が読取られ,トップ/ボトムマージン指定が5mmか否かが判別され,ノー(N)であればトップ/ボトムマージン変更テーブルデータD2の読取りが行われ,ボトムマージンテーブルデータD5とマージン変更テーブルデータD2との減算が行われ,トップマージン調整スイッチ442の内容が読取られ,スイッチに対応したトップマージン調整テーブルデータD3が読取られる。次にD5又は(D5-D2)の値にマージン調整テーブルデータD3を加減算し,その演算結果D4をページカウンタ279にセットする。次に指定紙サイズのライトマージンテーブルデータD7の読取が行われ,カセット/手差しの判別が行われる。カセット選択であれば上段(基準)か否かの判別が行われ,上段でなければ下段となり,カセット上段/下段調整スイッチ(図14の440)の内容を読取り,スイッチに対応したカセット上/下段調整テーブルデータD8を読取る。前記D7の値に前記D8を加減算し,その算出結果D9又は前記D7をライトマージンカウンタ277にセットする。又,手差しが指定された場合は,カセット/手差し調整スイッチ(図14の441)の内容を読取り,スイッチに対応したカセット/手差し調整テーブルデータD10を読取り,次に前記D7の値に調整テーブルデータD10を加減算し,その算出結果D11をライトマージンカウンタ277にセットする。

【0142】次に指定紙サイズのレフトマージンテーブルデータD12の読取が行われ,カセット/手差しの判

別が行われ、カセットであれば上段（基準）か否かの判別が行われ、上段でなければ下段と判断され、カセット上／下段調整スイッチ440の内容が読取られ、スイッチに対応したカセット上／下段調整テーブルデータD8が読取られる。前記D12の値に前記データD8を加減算し、その算出結果D13又は前記データD12をレフトマージンカウンタ276にセットする。又、手差しであれば、カセット／手差し調整スイッチ441の内容を読取り、スイッチに対応したカセット／手差し調整テーブルデータD10を読取り、そのデータD10と前記データD12の値との加減算を行い、その算出結果D14をレフトマージンカウンタ276にセットする。

【0143】前述のフロー中カセット用紙印字の詳細は図60のタイムチャートに示すようになっている。プリント開始信号IPRNTφ(S65)が出るとプリント開始許可信号IPREQφ(S62)が立上る。その後現像器モータ141等がONになり、時刻t4～t8の間で給紙モータ151が動作してカセット内の用紙を搬送する。このときレーザーダイオード344は時刻t5でONとなり、時刻t7からデータの書込みを開始する（時刻t7～t11の斜線の期間がデータ書込み期間）。時刻t9でレジストモータ149が回転し感光体への書き込みデータが用紙に転写される。データの書き込みはIPREQφ(S62)が立下る時刻t11まで行われ、時刻t11経過後時刻t12までレジストモータ149は回転し続けて停止する。レーザーダイオード344はその後時刻t14でOFFとなる。

【0144】図61及び図62は手差し用紙印字の動作説明のためのタイムチャートである。以下の説明では上記カセット用紙印字の場合と異なる部分について説明する。

【0145】図61及び図62では給紙モータ151を使用せずにレジストモータ149を逆回転させて給紙ローラを駆動し、用紙搬送用に用いており、正回転によりレジストローラを駆動するようにしている。また、両者共に「手差しコマンド」が来たらプリント開始指令IPREQφ(S62)が立上るようにしている。図61は「手差しコマンド」が発生する前に手差しガイドに用紙がセットされた場合を示し、用紙セットによりマニュアルフィードスイッチ326がONになるとその後時刻t01後にレジストモータ149が若干逆回転し用紙の先端を加え込んだ状態で止まり、「手差しコマンド」が出てIPREQφ(S62)が立上った時刻で再びレジストモータが逆回転し用紙を転写位置まで搬送して停止するようになっている。従って「手差しコマンド」を出す前であればカセットからの用紙への印字も可能である。図59の方は先に「手差しコマンド」が出た後に手差しガイドに用紙がセットされてマニュアルフィードスイッチ326がONになった場合であり、この場合は所定時間t01経過後にレジストモータ149を連続的

に逆回転させて転写位置まで搬送するようにしている。尚、いずれの場合もマニュアルストップスイッチ328がOFFしてから（時刻t20）所定期間経過後の時刻t21にレジストモータ149が停止となるようにしているが、これにより手差しガイドにセットされた用紙が表示されているサイズよりも長くても「ジャム」が発生しないこととなる。カセット用紙の場合はサイズが規定されているのでこのような配慮は必要ない。従って、カセット用紙が無くなった場合でも、印字すべき情報のサイズよりも大きなサイズの用紙を用意すれば印字を行うことができ、また、規格にはないサイズの用紙を用いることも可能となり、装置の利用度が増大する。

【0146】前記図47のフローから移行する丸棒A、B、Cのフローの内容について図63を参照して説明する。

【0147】テストプリントモードが選択されると丸棒Aのフローに移行し、テストキーを介してプリントモードNOで指定されたプリントの実行が行われる。メンテナンスモードが選択されると丸棒Bのフローに移行し、テストキーを介して指定されたNOのメンテナンスモードの動作が実行され、交換モードが選択されると丸棒Cのフローに移行し、「ドラム交換か」、「現像剤交換か」、「ヒートローラ交換か」が判別され、それぞれ「ドラム特性NOセット」、「現像剤交換NOセット」、「ヒートローラNOセット」によりテストキーを介して不揮発性RAM107に対する所定のデータの処理が行われる。

【0148】図64乃至図66は表示NOとそれぞれの内容とを対応付けた対応図である。

【0149】

【発明の効果】請求項1記載の発明によれば、極めて高精度に、かつ、安定した状態で半導体レーザーを制御できるレーザー制御装置を提供することができる。

【0150】請求項2記載の発明によれば、スイッチング手段の動作で光出力の安定化を確実に行うことができるレーザー制御装置を提供することができる。

【0151】請求項3記載の発明によれば、半導体レーザーの光出力の微小な制御を行うことができるレーザー制御装置を提供することができる。

【0152】請求項4記載の発明によれば、パワー損失を防止しつつ応答性が良好な状態で半導体レーザーを制御することができるレーザー制御装置を提供することができる。

【図面の簡単な説明】

【図1】本発明における装置と外部装置との関係を示すシステムブロック図である。

【図2】前記システム図における印字制御部（プリンタ）の概略断面図である。

【図3】図2におけるレーザースキャナユニットと記録用感光体との関係を示す概略斜視図である。

【図4】図2における給紙部分を示す概略図である。  
 【図5】図2における排紙部の一例を示す概略図である。  
 【図6】本実施例装置の操作パネル部を示す平面図である。  
 【図7】図6における表示部の拡大平面図である。  
 【図8】図1のデータ制御部の一例を示すブロック図である。  
 【図9】データ制御部で取扱われるデータのフォーマット図である。  
 【図10】データ制御部で取扱われるデータのフォーマット図である。  
 【図11】データ制御部内の記録部の領域と用紙との対応図である。  
 【図12】データ制御部で取扱われるデータのフォーマット図である。  
 【図13】図1における印字制御部のブロック図である。  
 【図14】図13における各検出器の詳細回路図である。  
 【図15】図13における駆動回路と出力素子の詳細を示すブロック図である。  
 【図16】図13におけるモータ駆動回路とレーザースキャンモータの詳細を示す回路図である。  
 【図17】図13におけるレーザ変調回路と半導体レーザを示す詳細回路図である。  
 【図18】半導体レーザと光出力との調係を示す特性図である。  
 【図19】半導体レーザと光出力との調係を示す特性図である。  
 【図20】図17の回路の動作説明のためのタイムチャートである。  
 【図21】図13におけるビーム検出回路とビーム検出器を示す詳細回路図である。  
 【図22】図21の回路の動作説明のための波形図である。  
 【図23】前記ビーム検出器の構造の一例を示す図である。  
 【図24】図21の回路の動作説明のための波形図である。  
 【図25】図13における印字データ書込制御回路の詳細回路図である。  
 【図26】図13におけるインターフェイス回路の回路図である。  
 【図27】本実施例装置に用いられるコマンドの略称と機能との関係図である。  
 【図28】本実施例装置に用いられるステータスの内容を示す説明図である。  
 【図29】図3における記録感光体へのビーム走査位置及びデータの書込位置等の関係図である。

【図30】図29の用紙サイズを含めた用紙全面の印字エリア部分を示す平面図である。  
 【図31】図25の回路の動作説明のためのタイムチャートである。  
 【図32】図25の回路の動作説明のためのタイムチャートである。  
 【図33】用紙に印字される印字パターン図である。  
 【図34】用紙に印字される印字パターン図である。  
 【図35】図25の回路における露光制御動作を説明するための露光位置と露光エネルギー、表面電位及び露光エネルギーと露光位置の関係を示す特性図である。  
 【図36】図25の回路における露光制御動作を説明するための露光位置と露光エネルギー、表面電位及び露光エネルギーと露光位置の関係を示す特性図である。  
 【図37】図15における帯電用高圧電源の詳細ブロック図である。  
 【図38】図37の回路の動作を説明するための特性図である。  
 【図39】図37の回路の動作を説明するための特性図である。  
 【図40】図37の回路の動作を説明するための特性図である。  
 【図41】図37の回路の動作を説明するための特性図である。  
 【図42】前記図2におけるレーザースキャンユニットと記録感光体との関係を示す概略図である。  
 【図43】記録感光体と用紙との関係を示す説明図である。  
 【図44】前記図5に示した排紙トレイの変形例を示す側面図である。  
 【図45】図13における各記録装置内に記録されるデータの詳細図である。  
 【図46】図13における各記録装置内に記録されるデータの詳細図である。  
 【図47】本実施例装置の全体動作を説明するためのフローチャートである。  
 【図48】本実施例装置の全体動作を説明するためのフローチャートである。  
 【図49】本実施例装置の全体動作を説明するためのフローチャートである。  
 【図50】本実施例装置の全体動作を説明するためのフローチャートである。  
 【図51】本実施例装置の全体動作を説明するためのフローチャートである。  
 【図52】本実施例装置の全体動作を説明するためのフローチャートである。  
 【図53】本実施例装置の全体動作を説明するためのフローチャートである。  
 【図54】本実施例装置の全体動作を説明するためのフローチャートである。

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【図 5 5】本実施例装置の全体動作を説明するためのフローチャートである。

【図 5 6】本実施例装置の全体動作を説明するためのフローチャートである。

【図 5 7】本実施例装置の全体動作を説明するためのフローチャートである。

【図 5 8】本実施例装置の全体動作を説明するためのフローチャートである。

【図 5 9】本実施例装置の全体動作を説明するためのフローチャートである。

【図 6 0】本実施例装置の動作説明のためのタイムチャートである。

【図 6 1】本実施例装置の動作説明のためのタイムチャートである。

【図 6 2】本実施例装置の動作説明のためのタイムチャートである。

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【図 6 3】本実施例装置の動作を説明するためのフローチャートである。

【図 6 4】本実施例装置における装置の番号との内容を示す関係図である。

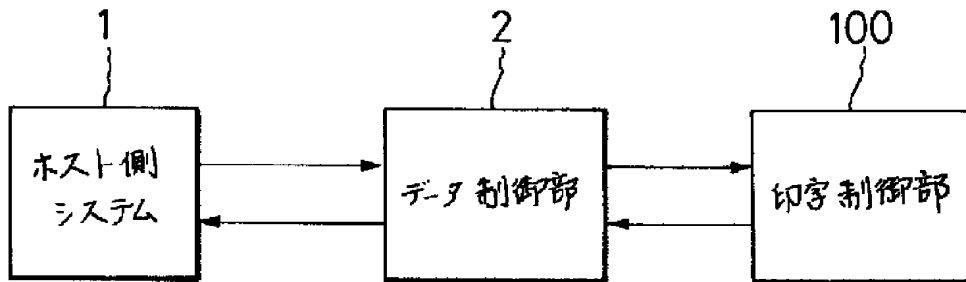
【図 6 5】本実施例装置における装置の番号との内容を示す関係図である。

【図 6 6】本実施例装置における装置の番号との内容を示す関係図である。

【符号の説明】

- 10 1 2 0 レーザー変調回路  
2 3 6 アナログスイッチ  
2 5 9 レーザーダイオード  
2 6 0 フォトダイオード  
2 5 7 高周波トランジスタ  
3 4 4 半導体レーザー

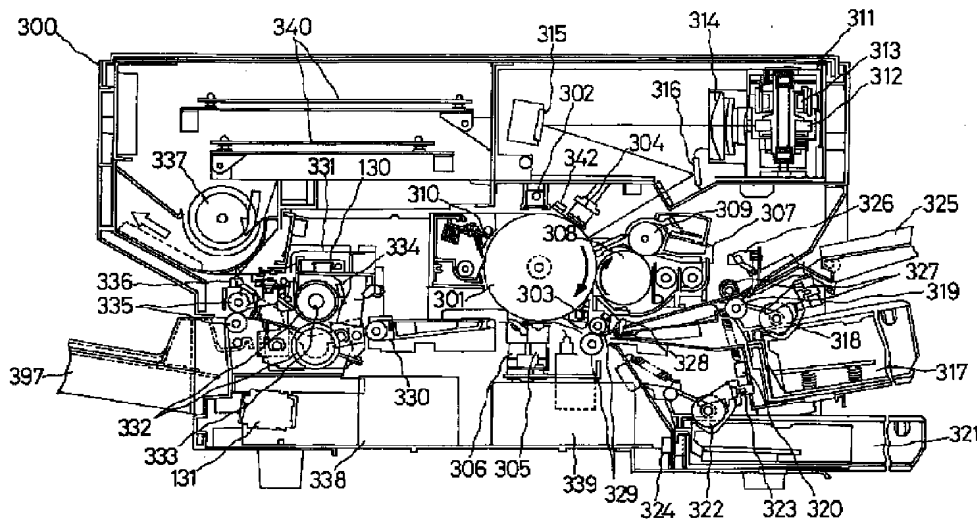
【図 1】



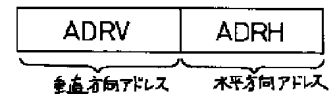
【図 4 6】

TIM A
TIM B
}
TIM E
紙サイズレジスタ
ステータス 1
ステータス 2
}
ステータス 6
その他

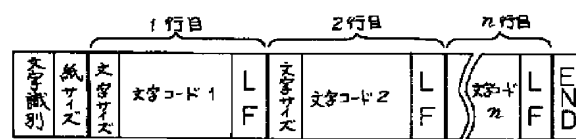
【図 2】



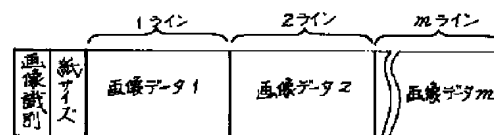
【图 1 2】



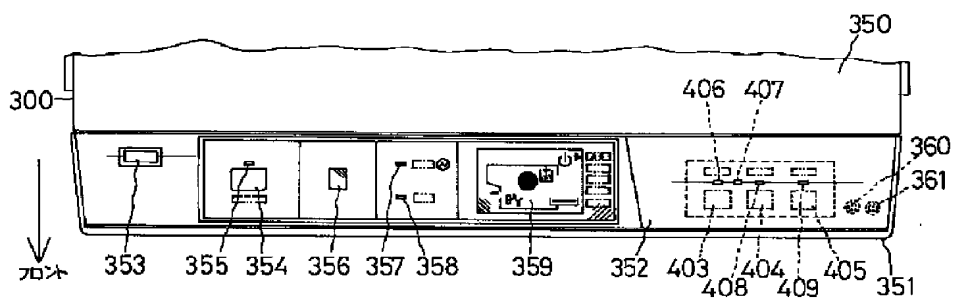
【图9】



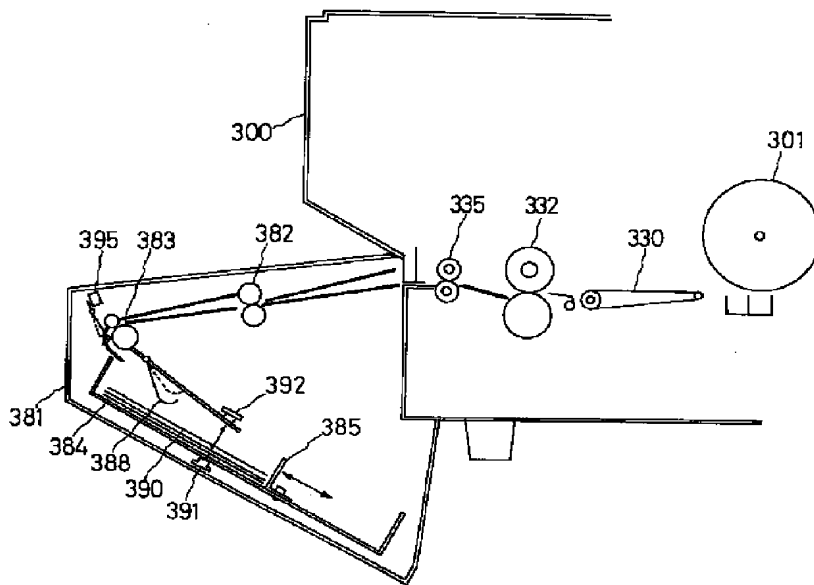
【図 10】



【图 6】



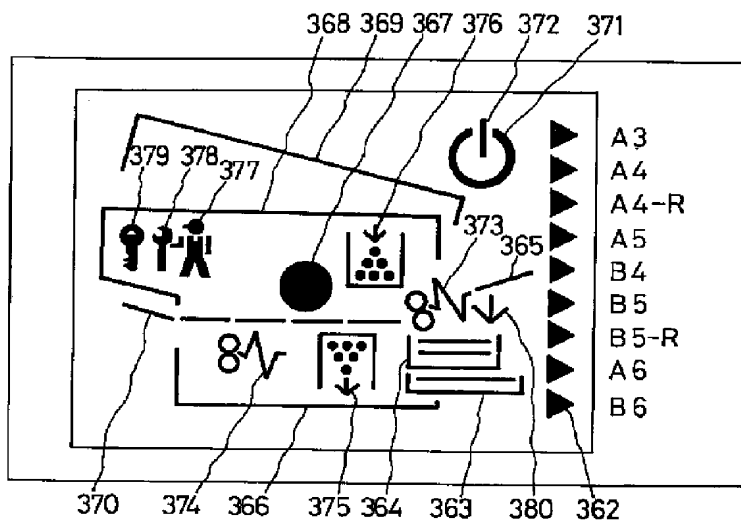
【図5】



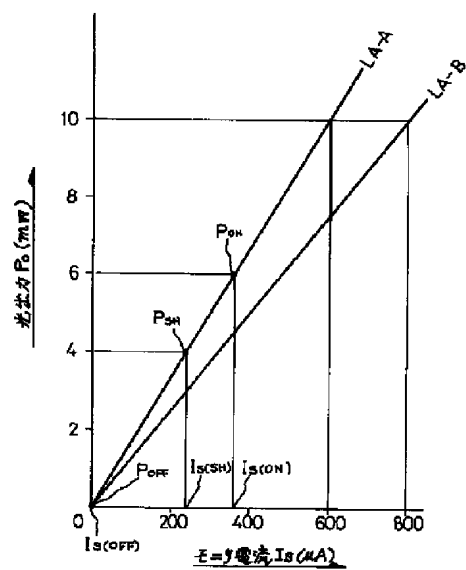
【図24】



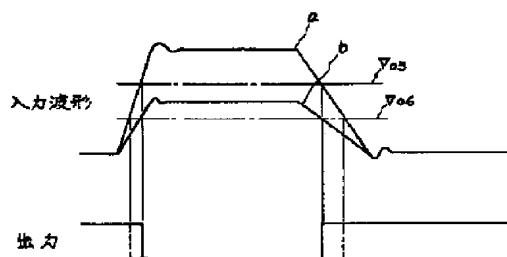
【図7】



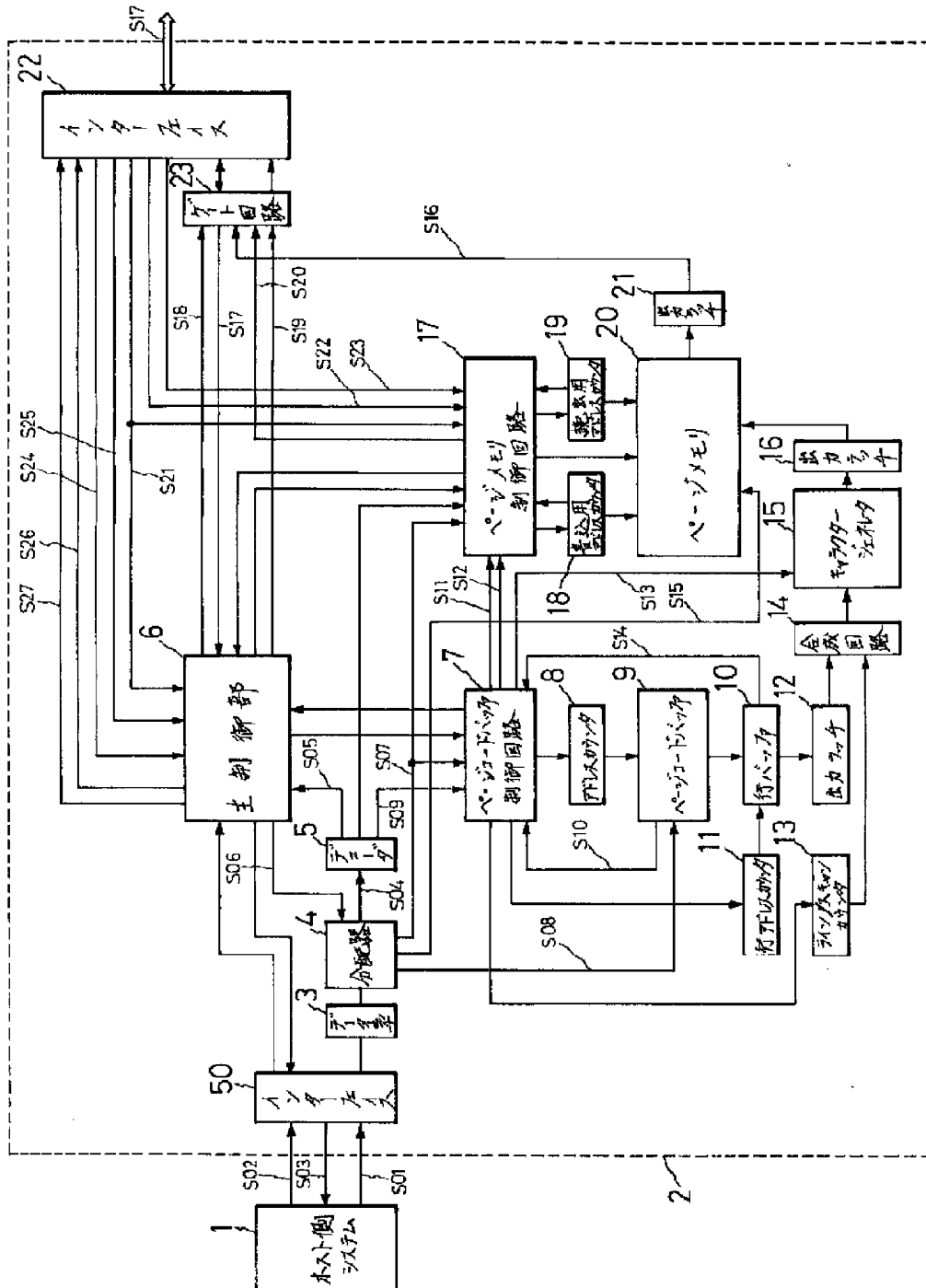
【図19】



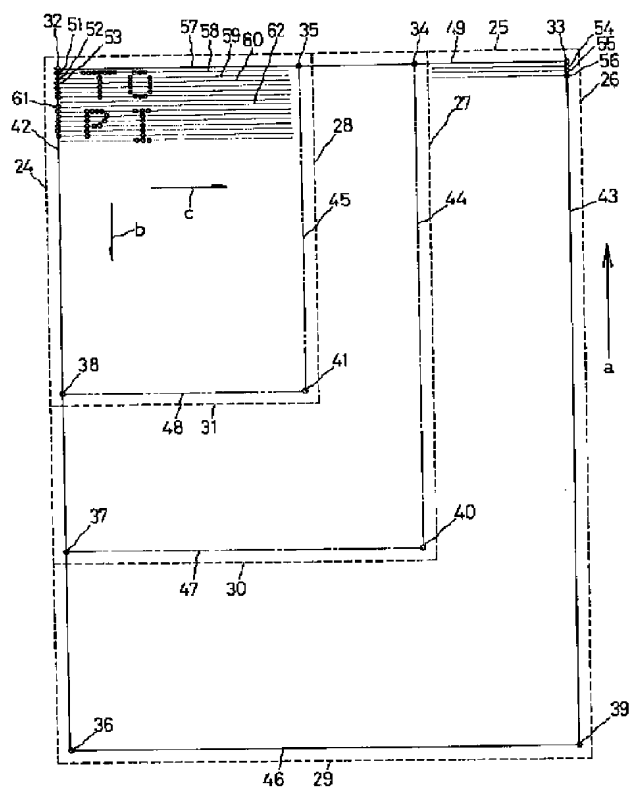
【図22】



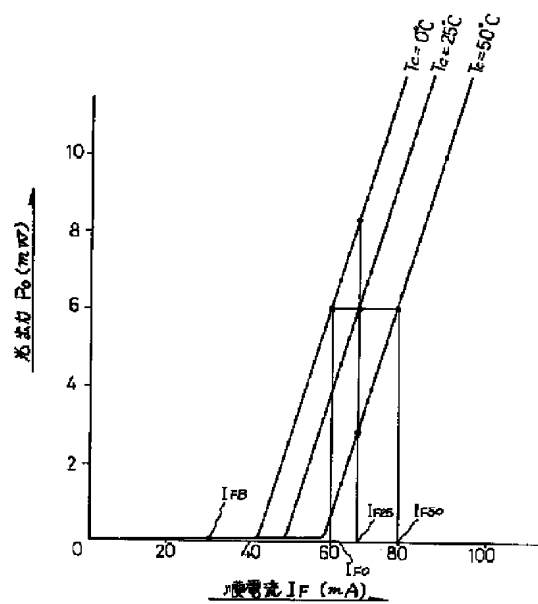
【図8】



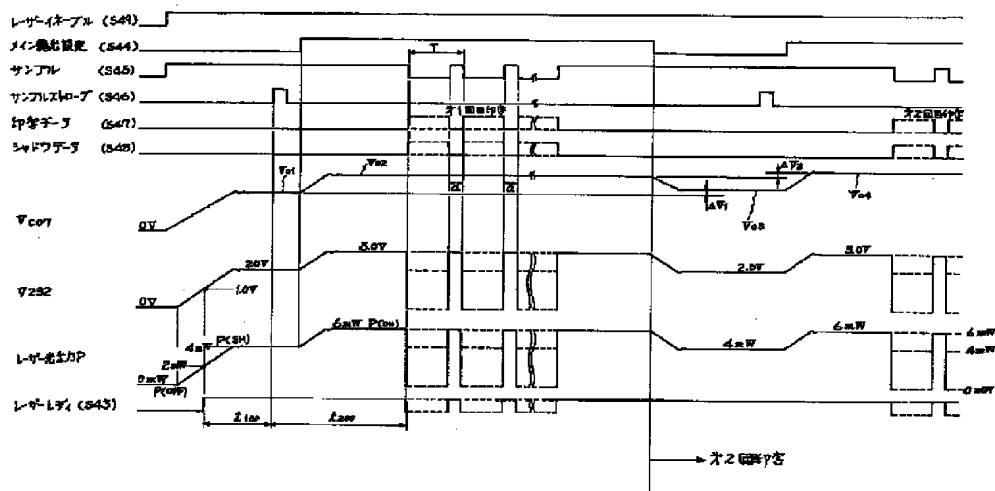
【図11】



【図18】

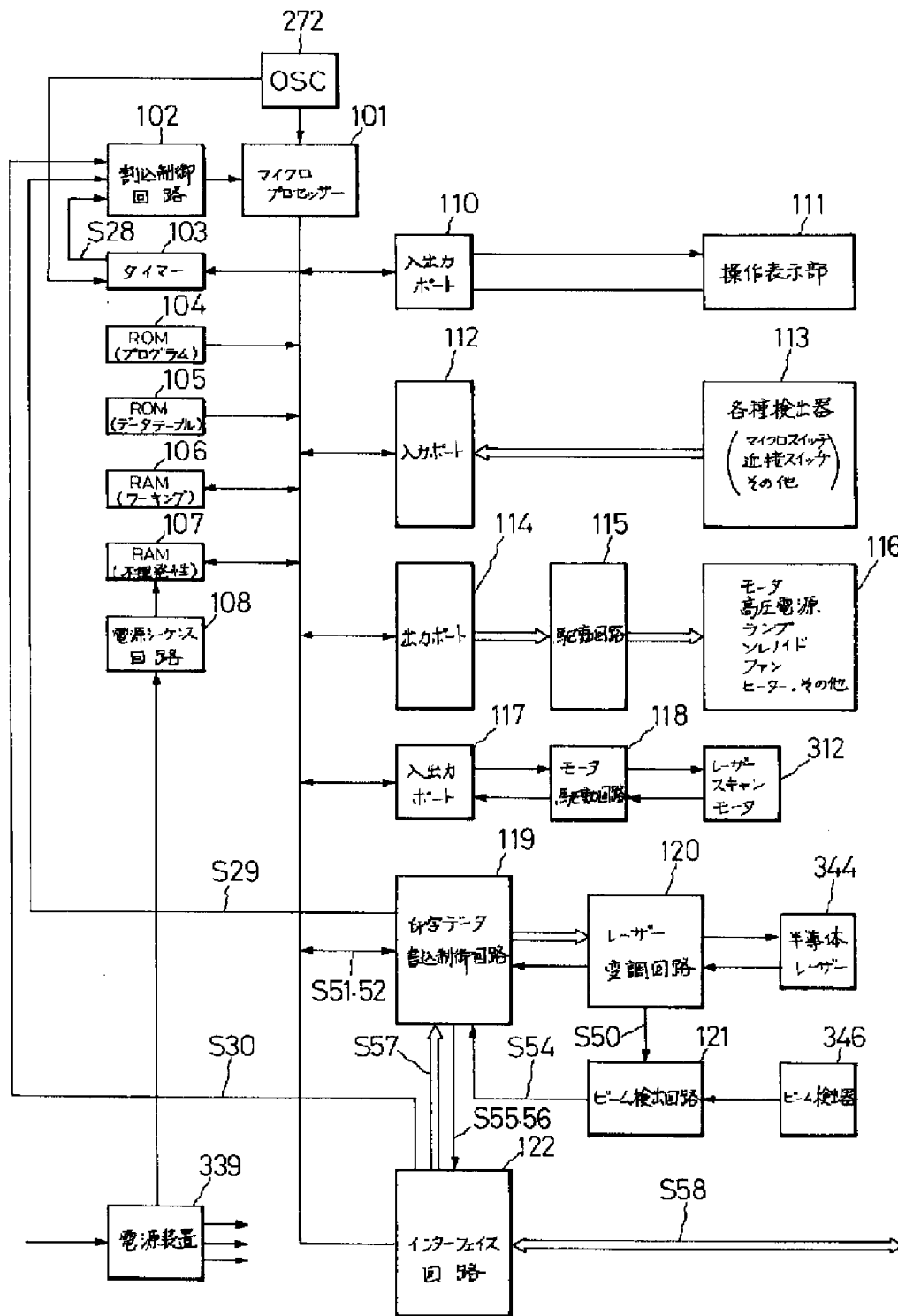


【図20】

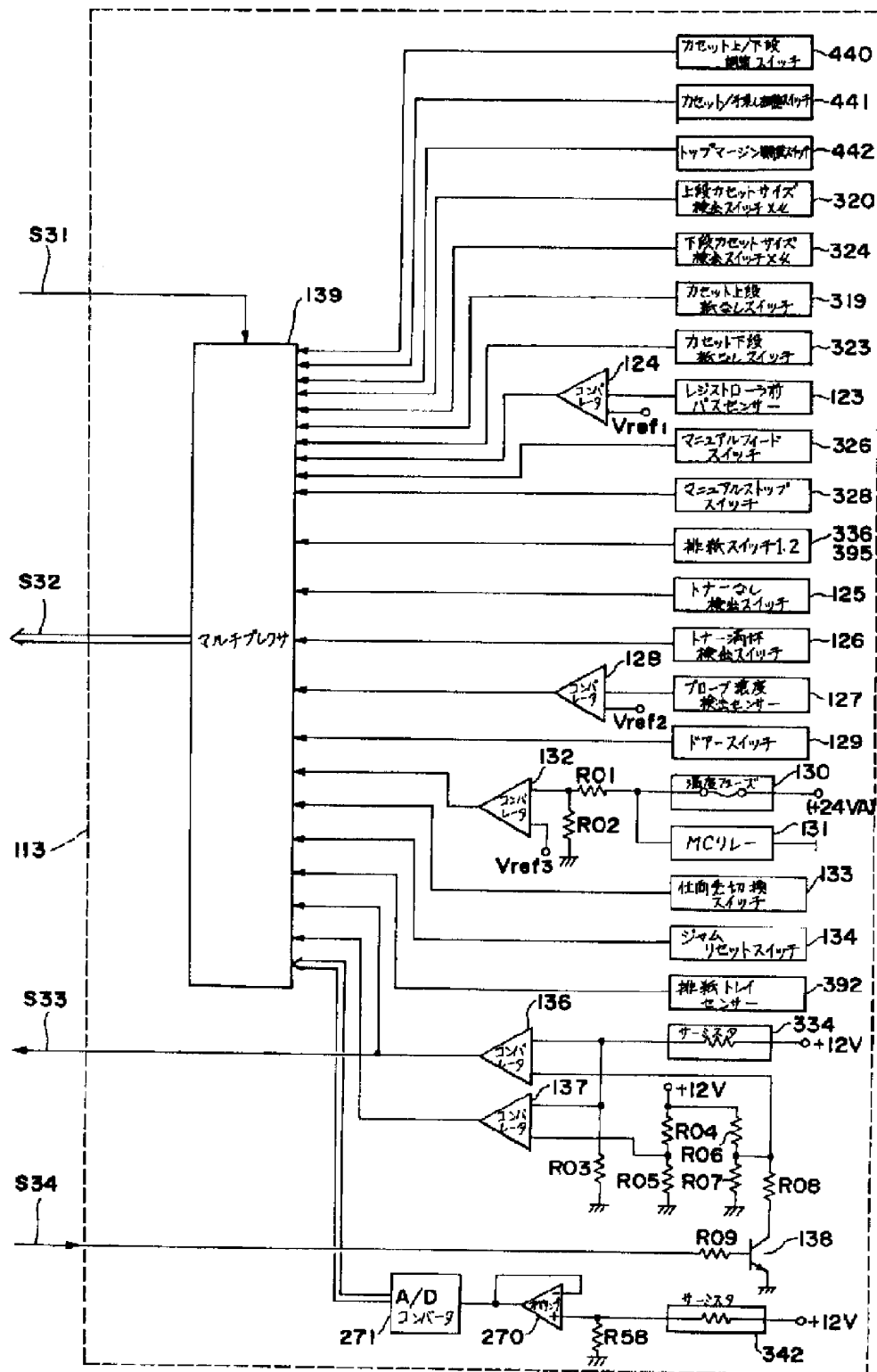




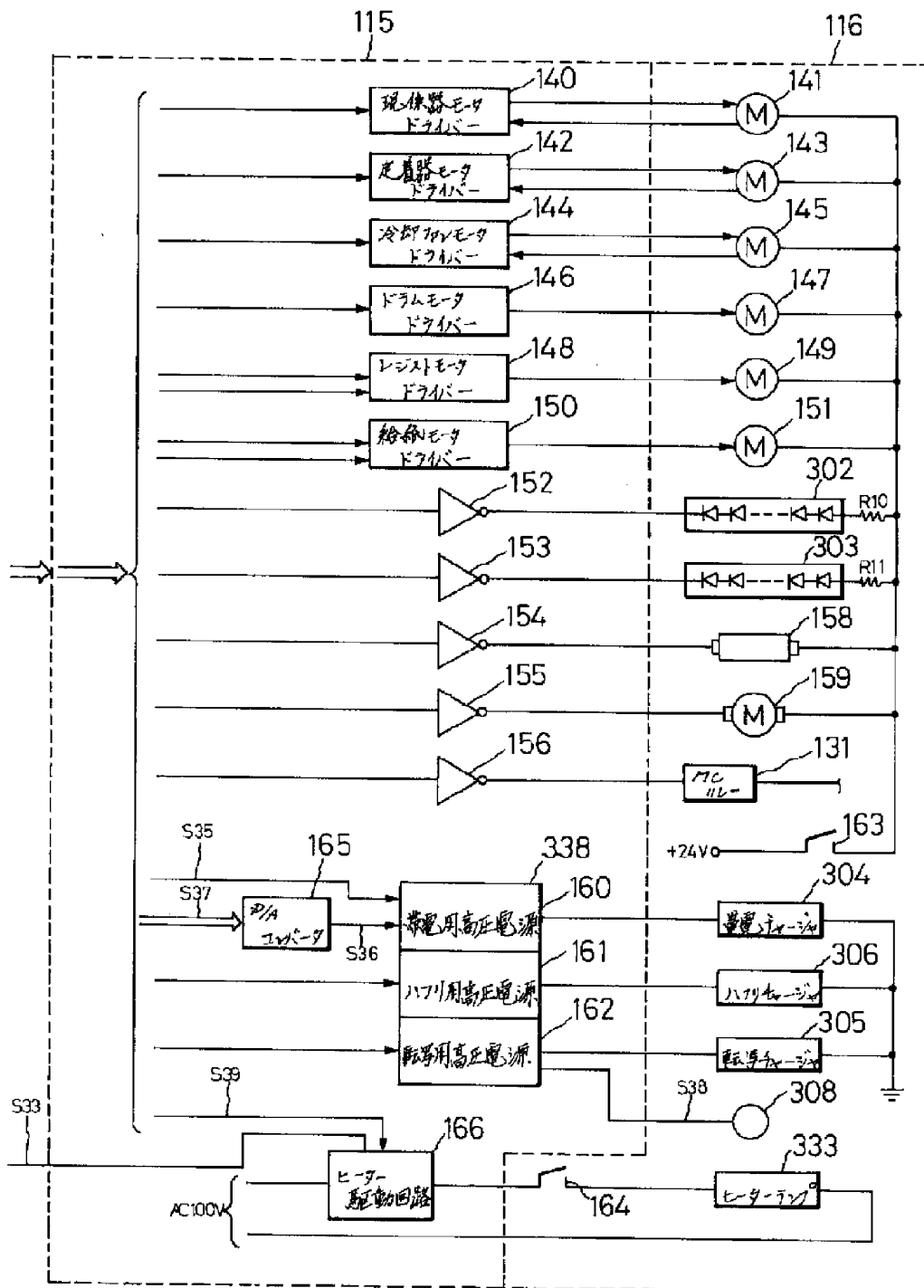
【図13】



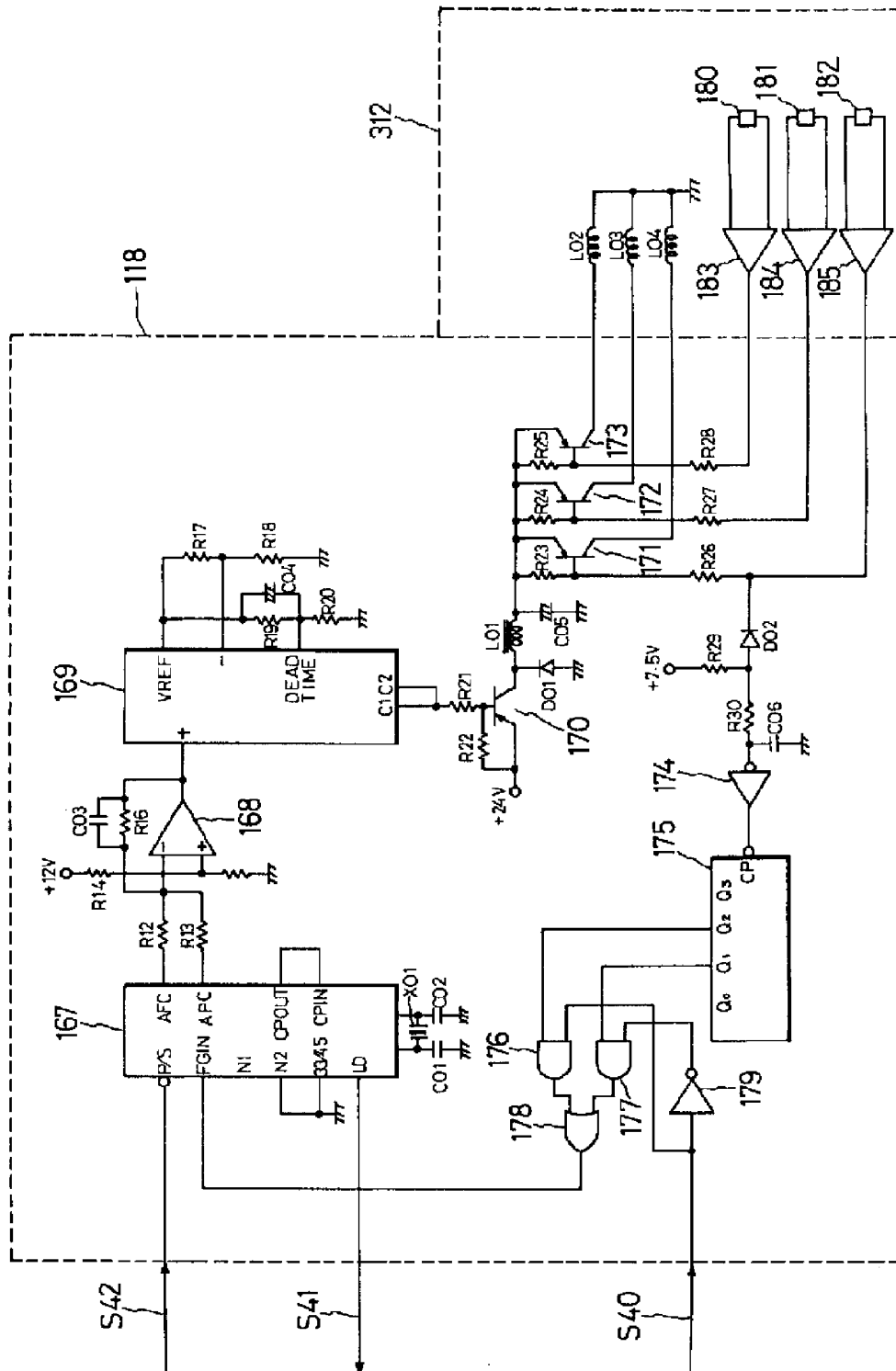
【図14】



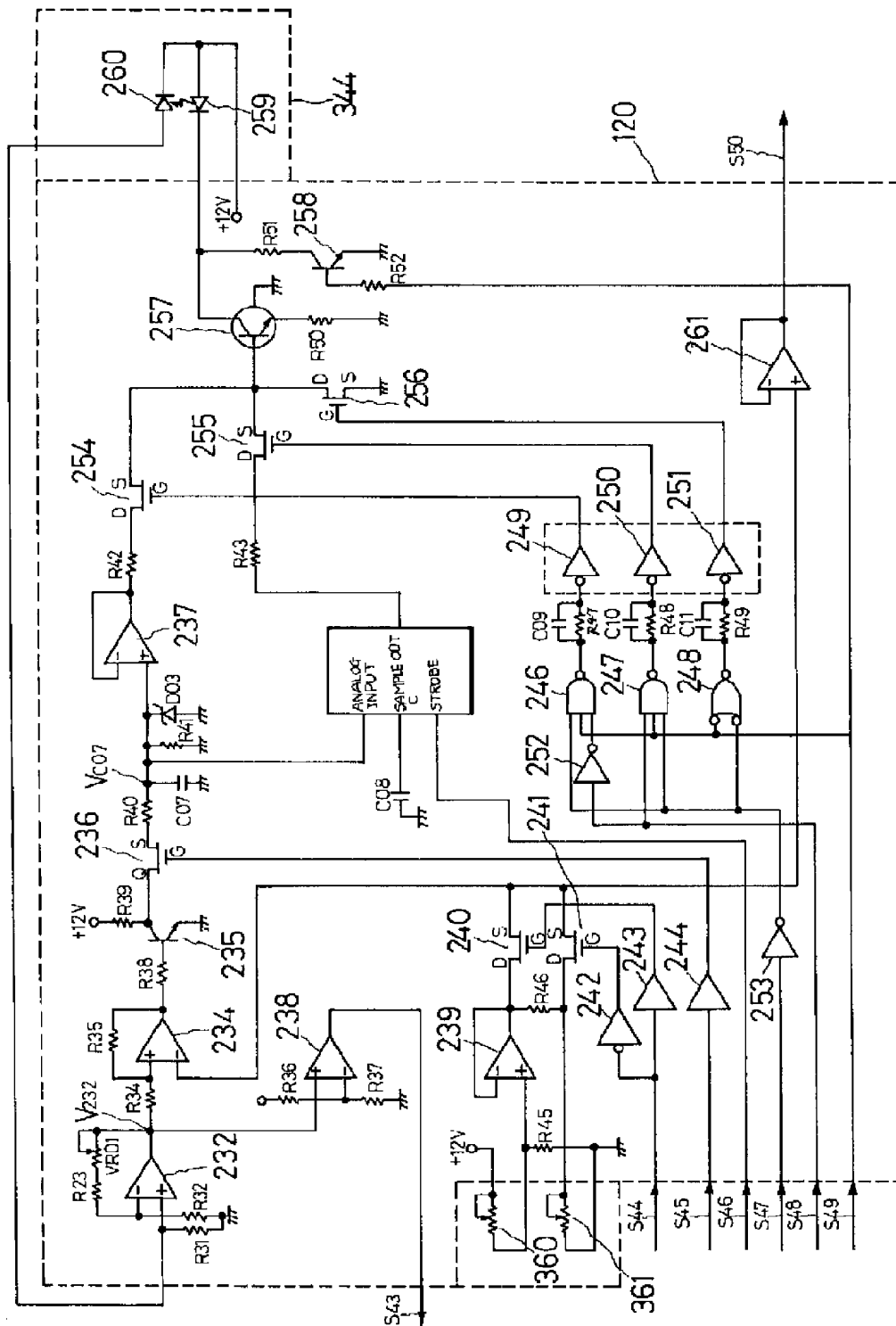
【図15】



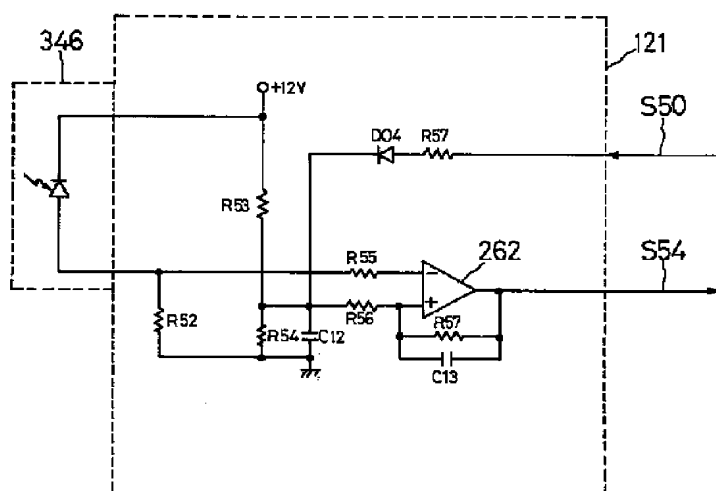
【図16】



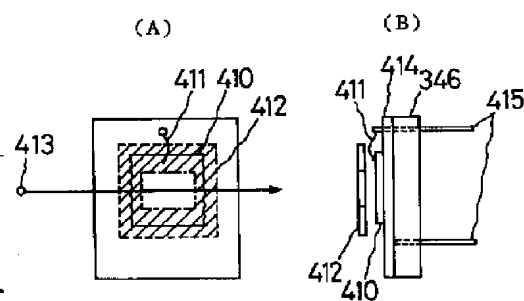
【図17】



【図21】



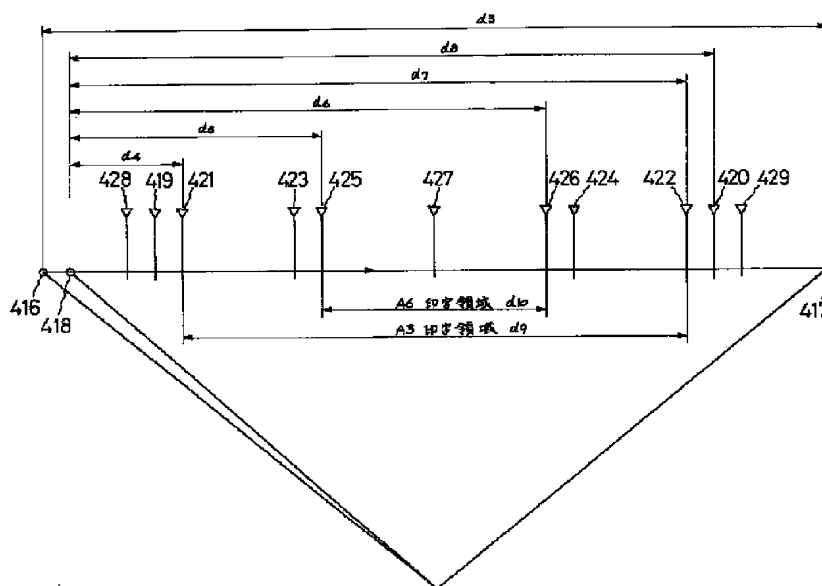
【図23】



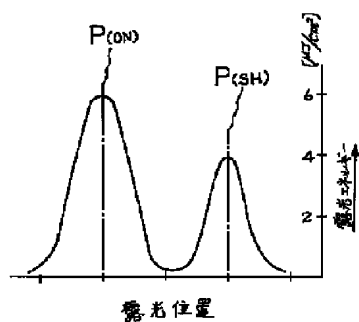
【図27】

コマンド略称	機 能
SR 1	ステータス1要求
" 2	" 2 "
" 3	" 3 "
" 4	" 4 "
" 5	" 5 "
" 6	" 6 "
PS0N	パワーセーブ
PS0F	パワーセーブ解除
CSTU	カセット上段指定
CSTL	" 下段指定
SELON	セレクトランプ点灯
SELOF	" 消灯
VSYNC	画像データ転送開始
MF 1	手差し指定 (A3 7チ)
" 2	" (A4 7チ)
" 3	" (A4 ヨコ)
" 4	" (A5 7チ)
" 5	" (A6 7チ)
" 6	" (B4 7チ)
" 7	" (B5 7チ)
" 8	" (B5 ヨコ)
" 9	" (B6 7チ)
TBM 1	トップ/ボトムマージン (5mm)
" 2	" (10mm)
" 3	" (15mm)
" 4	" (20mm)
SONF	シャドウ ON/OFF

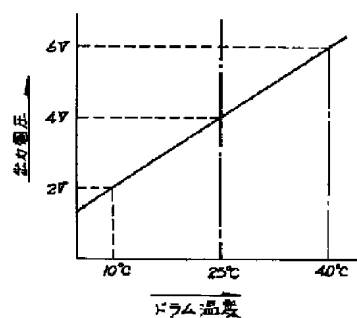
【図29】



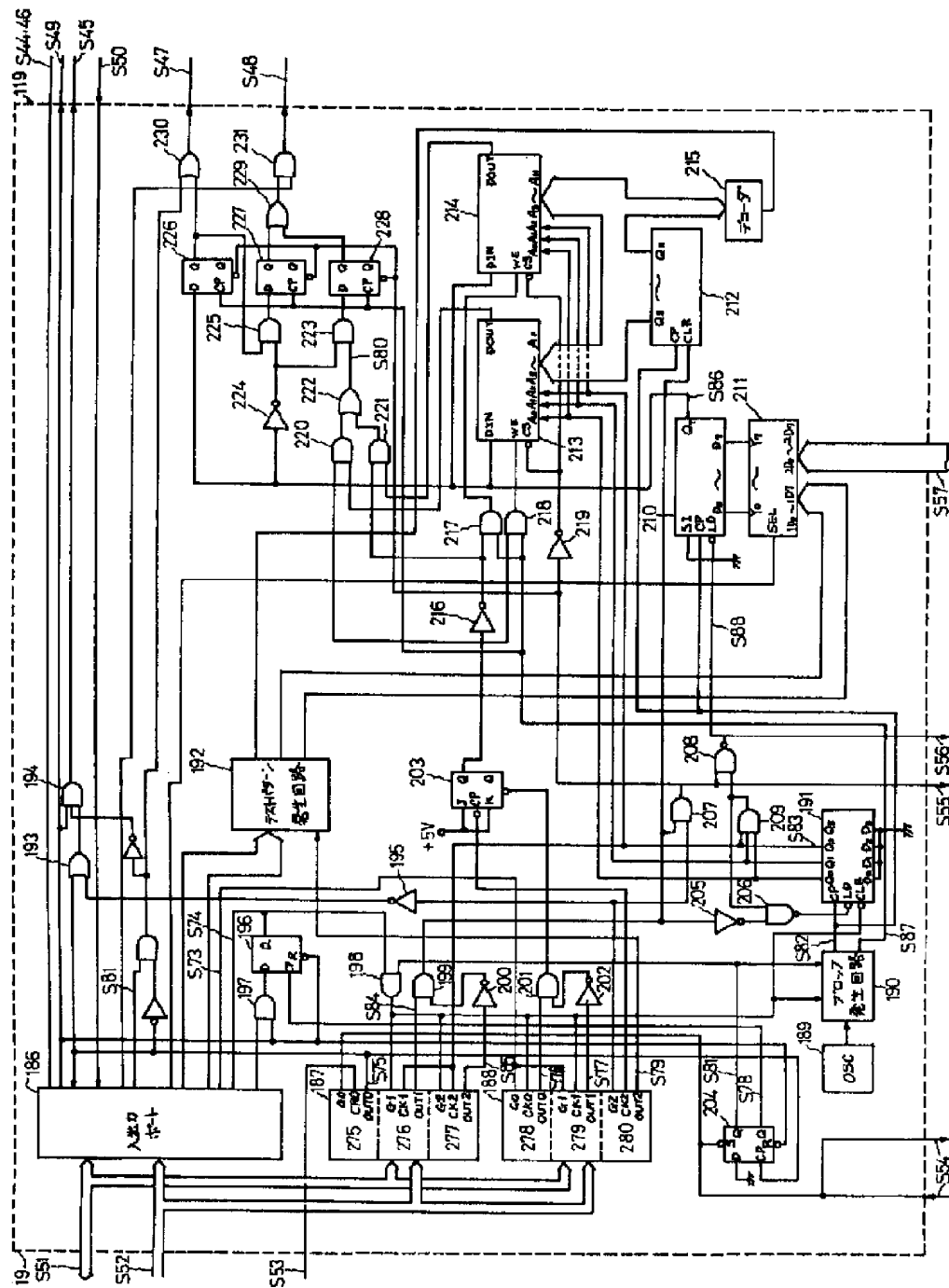
【図35】



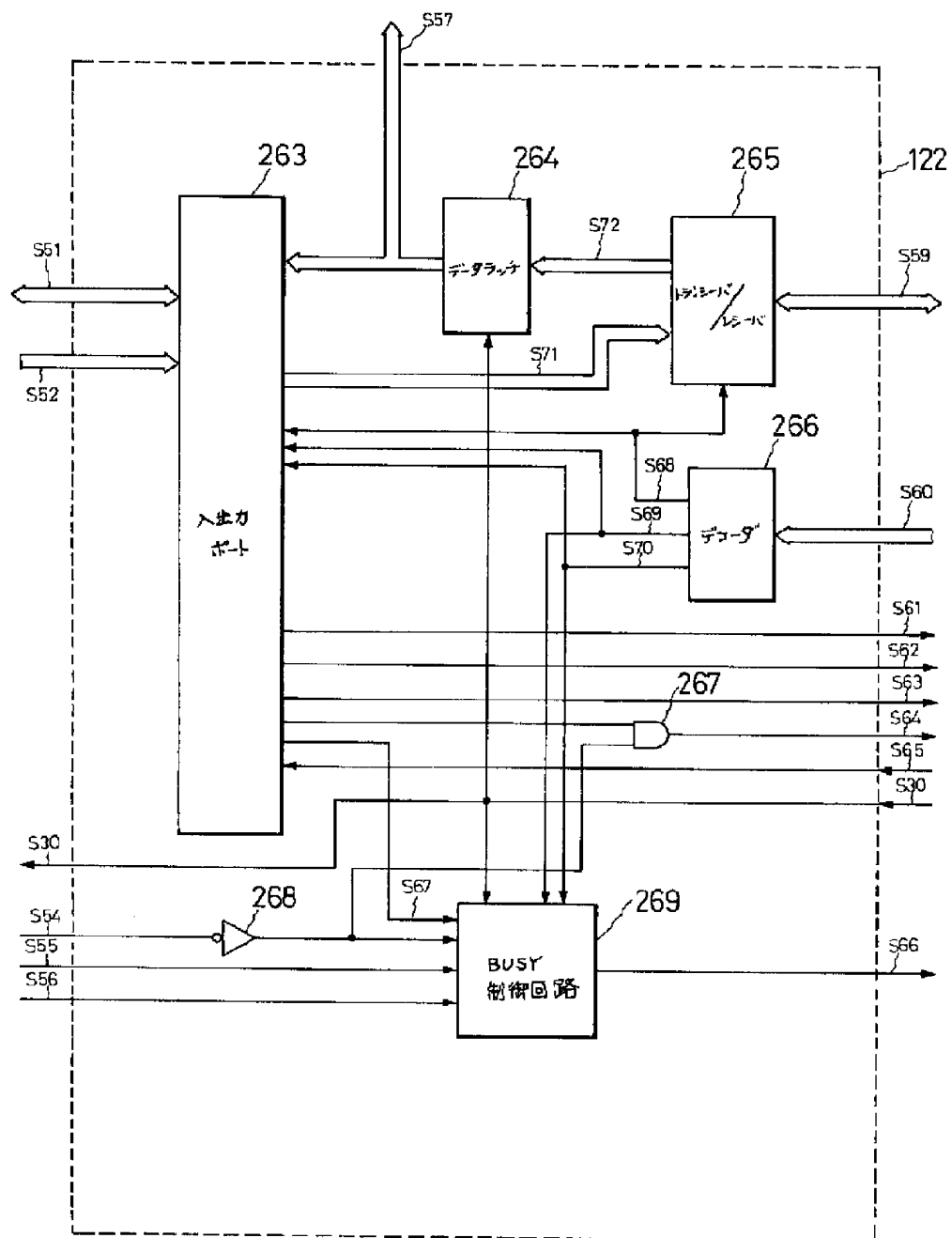
【図41】



【図25】



【図26】

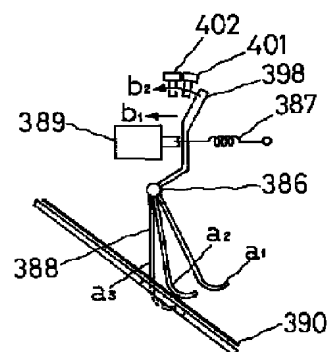




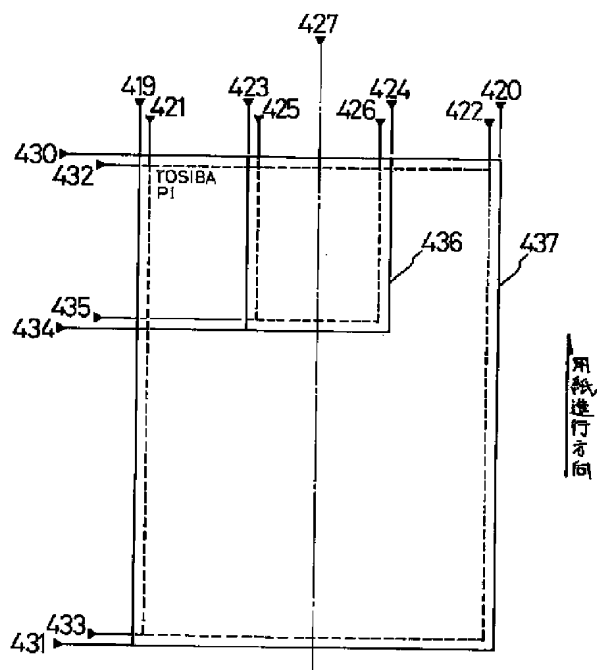
【図28】

	DATA 8i	DATA 7i	DATA 6i	DATA 5i	DATA 4i	DATA 3i	DATA 2i	DATA 1i
ステータス1	本 法 コ マ ン ド エ ラ ー	紙搬送中	セレクトスイッチ ON	VSYNC リクエスト	チ差し	カセット上段/機	トップ/ボトムマージン	
ステータス2		シャドウON	カセットサイズ（上段）			カセットサイズ（下段）		
ステータス3			テスト/リテナス 中	データ再送要求	ウェイト中	パワーセーブ中	オーバーテール	サービスマン コール
ステータス4		トレイフル	トナーバック 交換	紙なし	紙ジャム	トナーエラー	カバーオープン	—
ステータス5		タイミングエラー	定着器故障	レーザー故障	スキャンモータ 故障	ヒトローラ 交換	ドラム交換	現像剤交換
ステータス6		—	—	—	—	再送枚数		

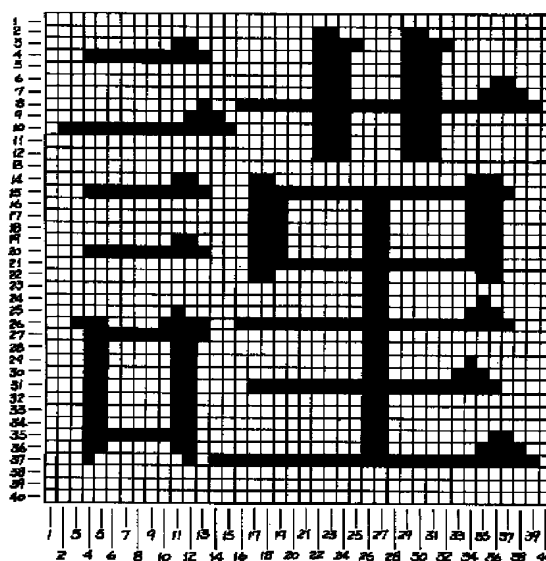
【図44】



【図30】

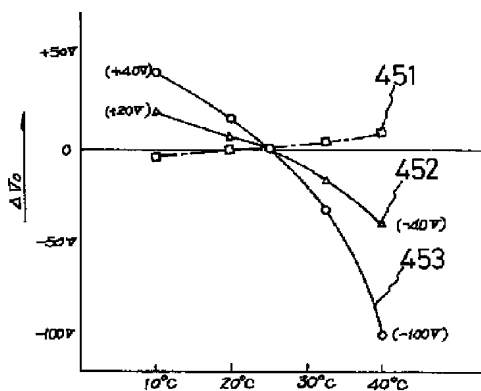
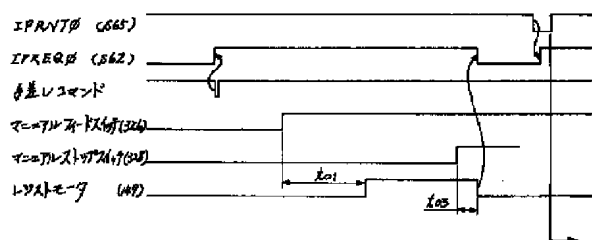


【図33】

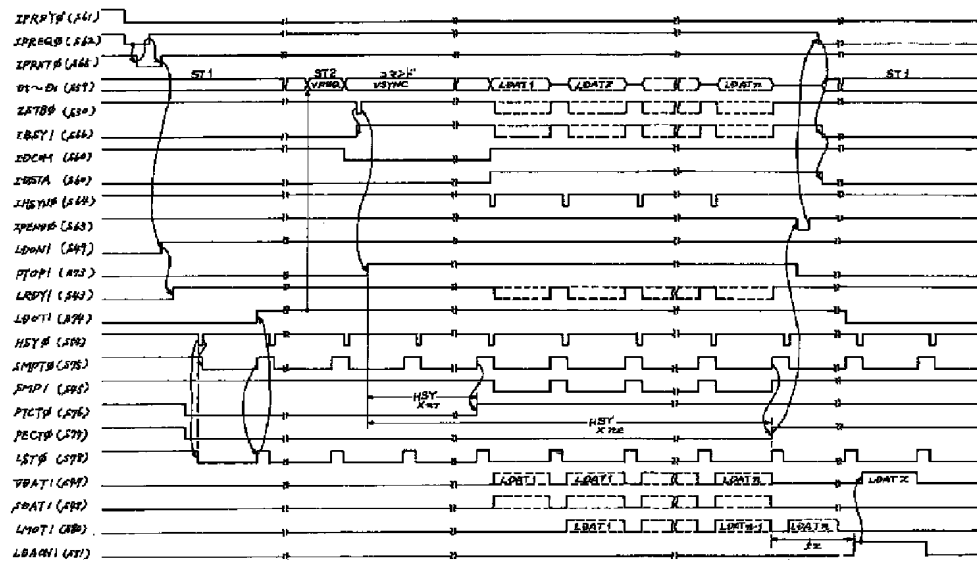


【図38】

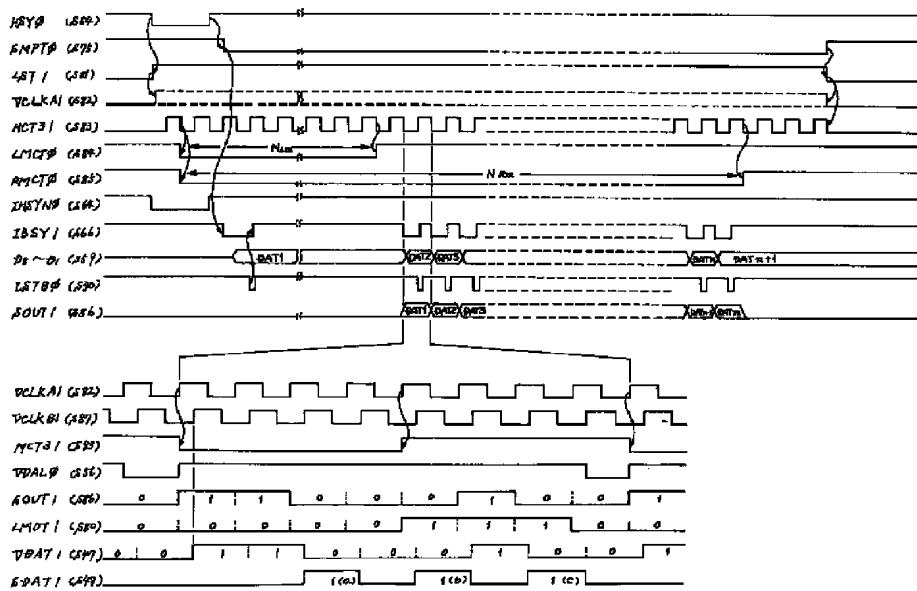
【図62】



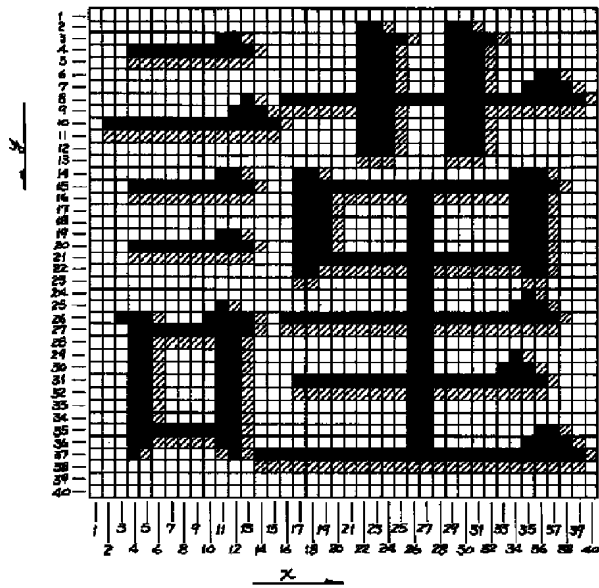
【図31】



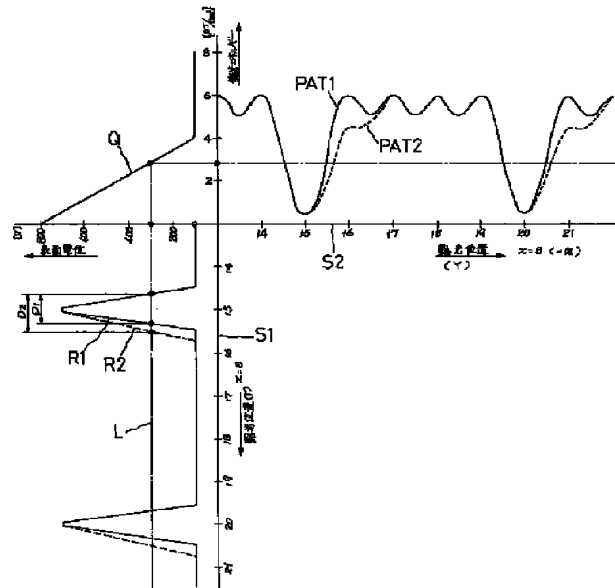
【図32】



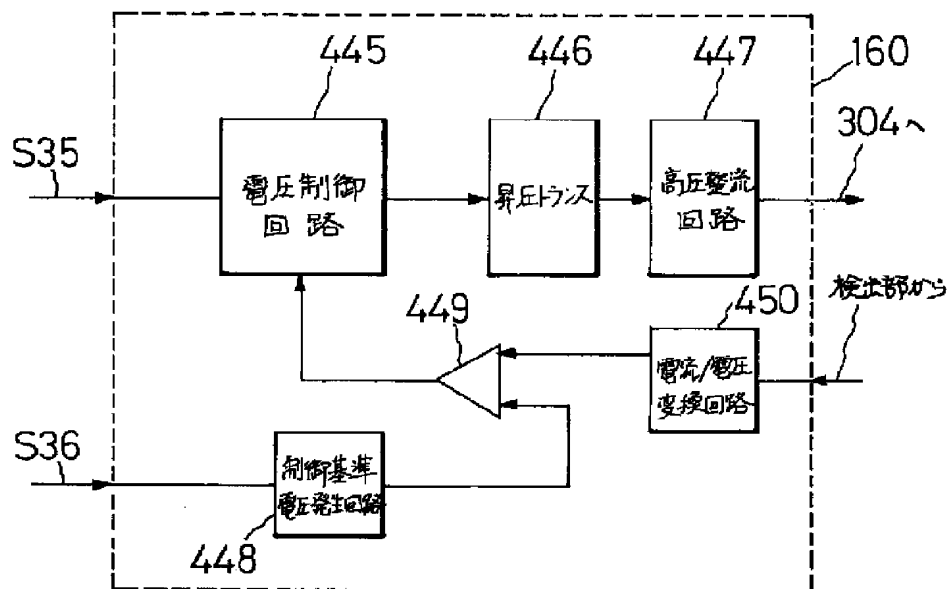
【図34】



【図36】



【図37】





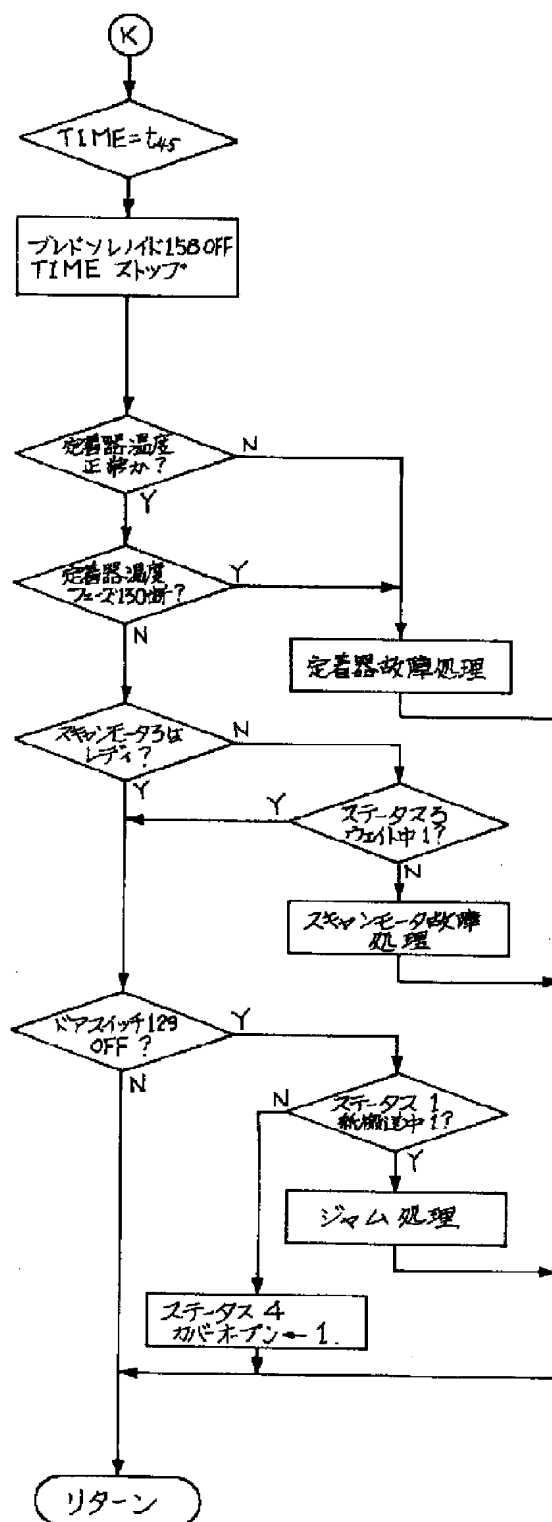
【図45】

(A)		(B)	
アドレス	内 容	アドレス	内 容
4000	A3	6000	ドラム 検査 A0
4001		6100	ジヤム 発生
4002		6200	排紙トレイカウンタ
4003		6300	ドラム交換カウンタ
4004		6400	現像剤交換カウンタ
4005	B4	6500	定着ローラ交換カウンタ
4006			
4007			
4008			
4009			
400A	A6		
400B			
400C			
400D			
400E			
400F	A6		
4010			
4080			
4081			
4082			
4083			
4084			
4085			
4086			
4087			
4100	トップ/ボトム マージン変更 テーブル		
	トップマージン 調整テーブル		
	カセット上/下 調整テーブル		
	カセット/手差し 調整テーブル		
4200	ドラム 検査 テーブル		
4201			
4202			
4203			
4204			
42FF	交換 テーブル (ドラム)		
4300			
4301			
43FF			
4400	制御用タイマーテーブル		
4401			
4402			
4403			
44FF			

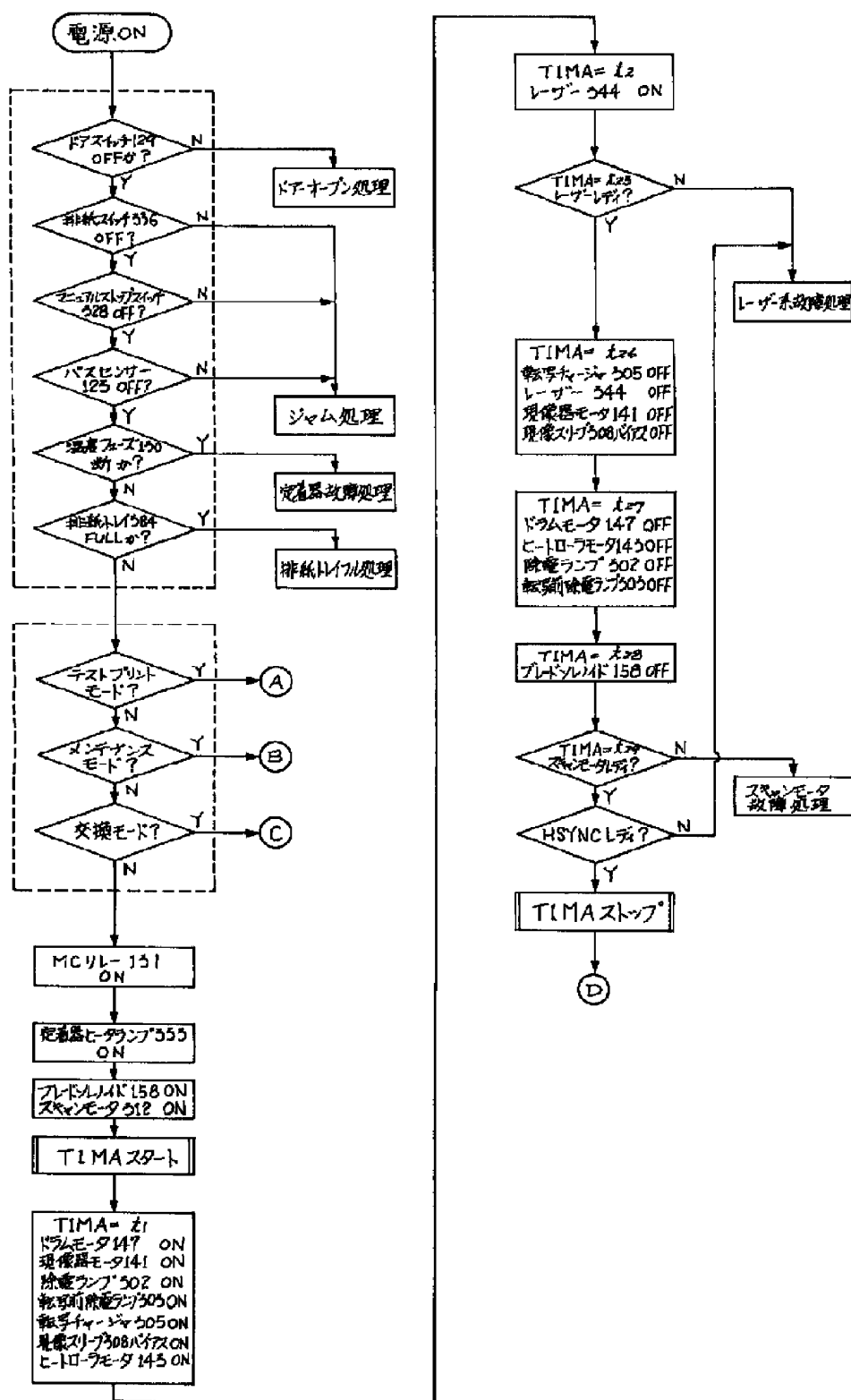
【図64】

表示	エラー 内容
ブランク	サービスマンコールなし
1	レーザー故障
2	HSYNC検出故障
3	スキャンモータ故障
4	定着器故障
5	データ転送エラー
6	ドラム交換
7	ヒートローラ交換
8	現像剤交換

【図53】



【図47】



[illegible]

【図49】

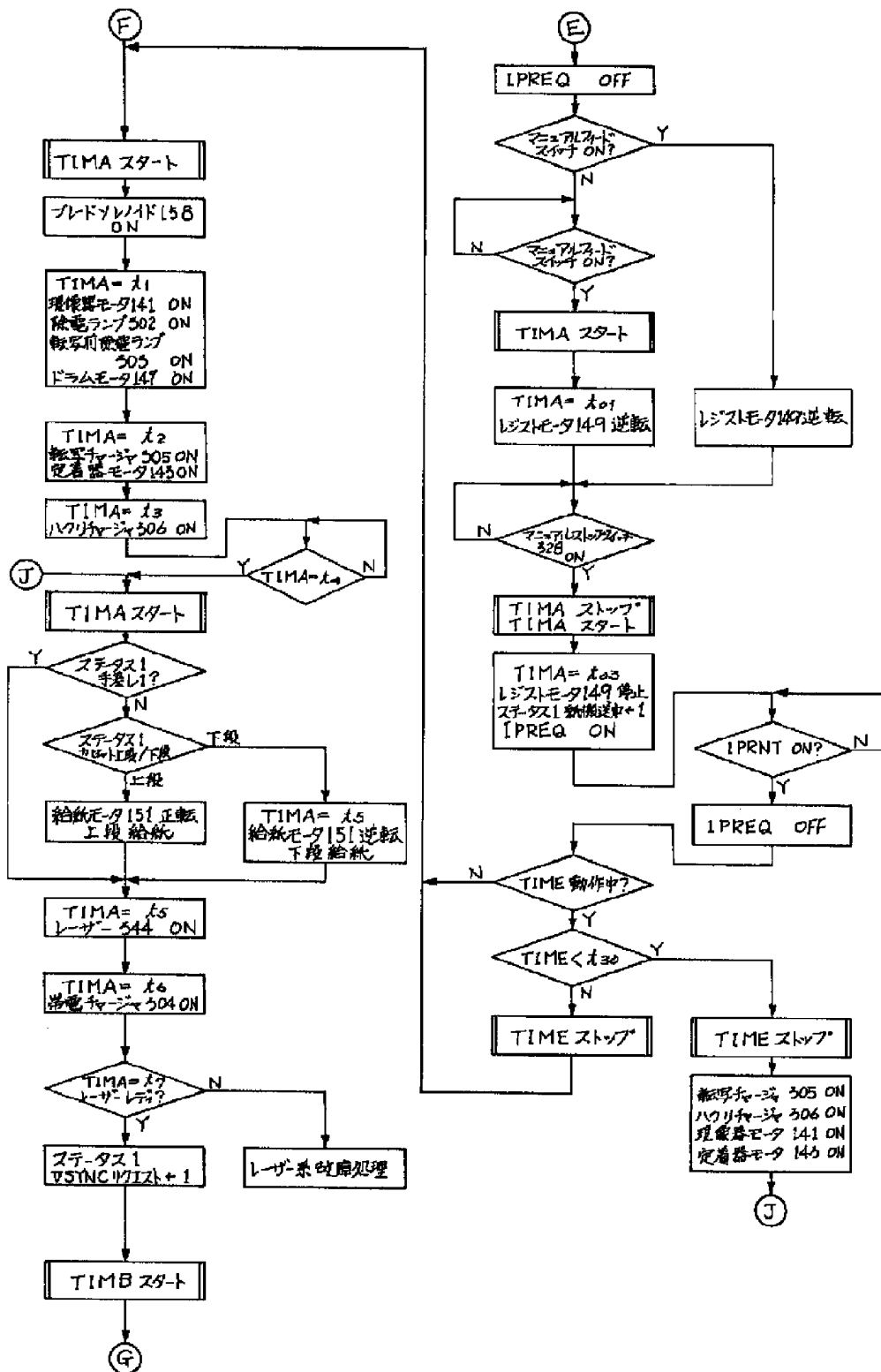


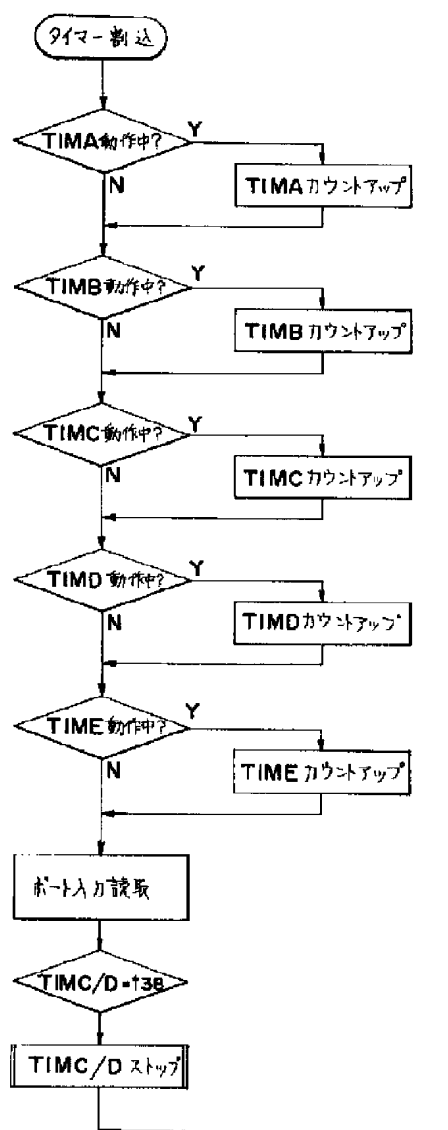


Figure 10 is a flowchart of the control sequence for the laser beam scanning operation. The process begins at point G, where T1MA is set to 131 and the absolute time 151 is stopped. A decision is made on whether the SYNC signal is received. If not, T1MB is set to 144 and the laser beam is turned off. If received, a decision is made on whether T1MB is less than 142. If not, T1MB is set to 147 and the laser beam is turned off. If yes, a decision is made on whether T1MB is less than 143. If not, T1MB is set to 143 and the laser beam is turned off. If yes, T1MB is stopped and T1MA is started. The process then proceeds to a series of steps where T1MA is set to 11, 12, 13, 14, 15, 16, and 17, and the absolute time 151 is stopped. A decision is made on whether T1MA is less than 17. If not, the laser beam is turned off. If yes, T1MA is stopped and the laser beam is turned off. The process then proceeds to a series of steps where T1MA is set to 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794

```

graph TD
    Start((H)) --> D1{トナー選択検出  
スイッチ126 ON?}
    D1 -- Y --> P1[トナー選択表示 STPF ← 1  
ステータス4 トナー選択 → 1]
    P1 --> D2{トナーなし検出  
スイッチ125 ON?}
    D2 -- Y --> P2[トナー補給表示 STPF ← 1  
ステータス4 トナーなし → 1]
    P2 --> D3{ステータス1  
手差し1?}
    D3 -- Y --> D4{指図が認められる?}
    D4 -- Y --> P3[カセット紙なし表示 STPF ← 1  
ステータス4 紙なし → 1]
    P3 --> D3
    D3 -- N --> D4
    D4 -- N --> T1[TIME スタート]
    T1 --> D5{STPF=1?}
    D5 -- Y --> S1[STPF ← 0]
    S1 --> I1[IPRDY OFF]
    I1 --> D6((D))
    D5 -- N --> D7{ステータス1  
手差し1?}
    D7 -- Y --> T2[TIME ストップ]
    T2 --> D8{マニュアルストップスイッチ  
328 OFF}
    D8 -- N --> T2
    D8 -- Y --> T3[TIME スタート]
    T3 --> P4[ステータス1手差し → 0  
TIMB ストップ]
    P4 --> D9{カセット紙なし  
検知 ON?}
    D9 -- Y --> P5[ステータス4  
紙なし → 1]
    P5 --> D5
    D9 -- N --> P6[IPREQ ON]
    P6 --> D10((1))
    D10 --> D5
  
```

【図52】

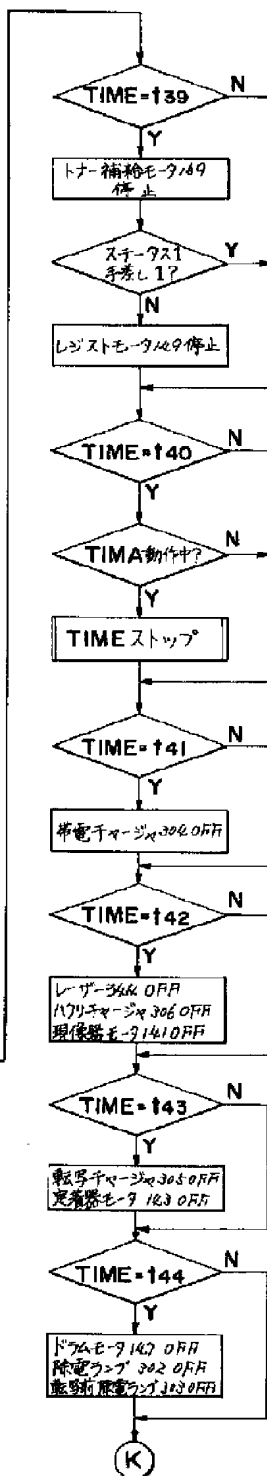


【図55】

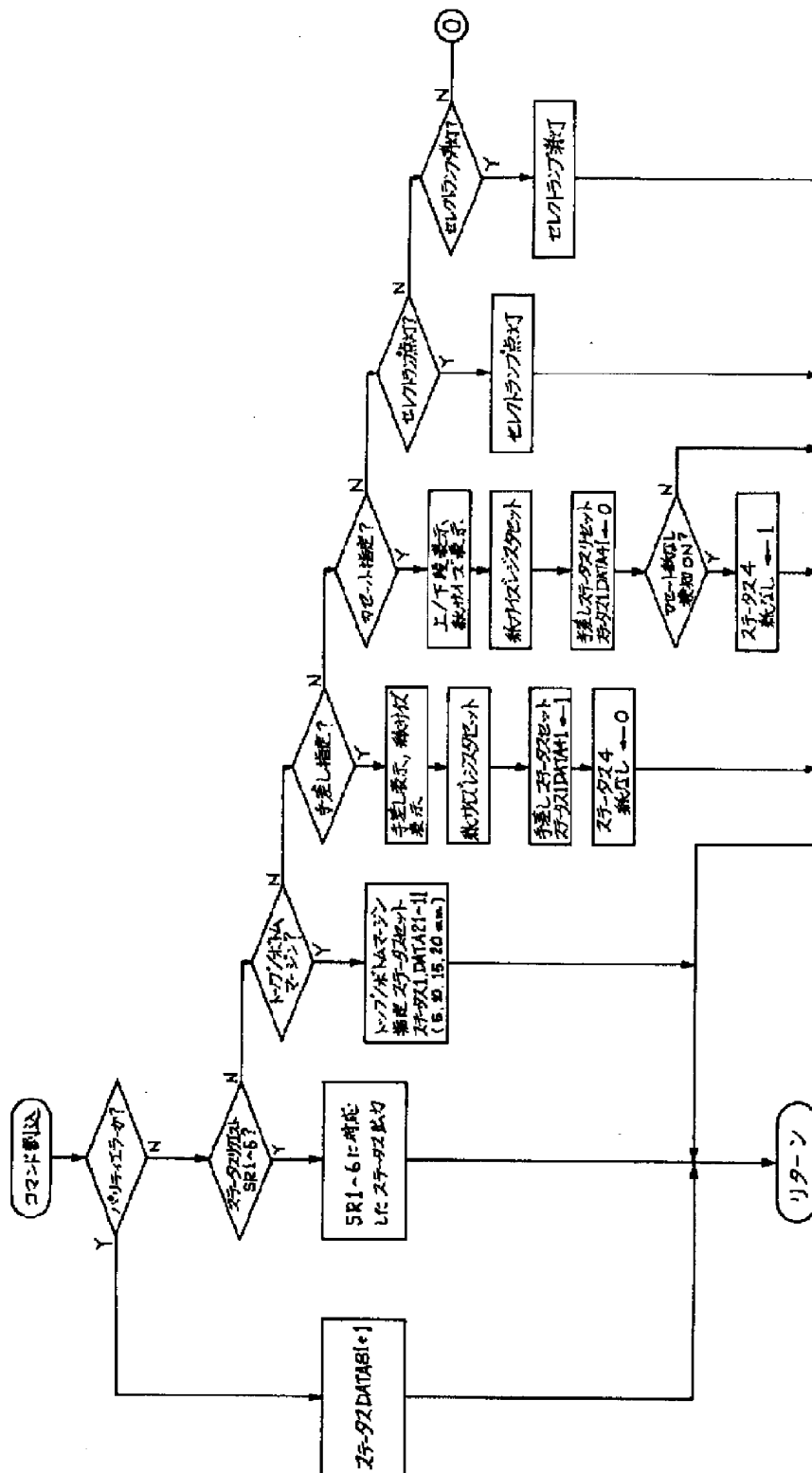
表示	メンテナンス動作内容
0	コンパネ表示全ON
1	オートトナー調整
2	トナー補給
3	スキャタ レザ ドラムモータ
4	除電ランプ 紙屑排除電ランプ
5	レジストモータ
6	給紙モータ
7	帯電チャージ
8	転写チャージ 現像バイアス
9	ハブリチャージ
A	紙なしフリント動作

【図66】

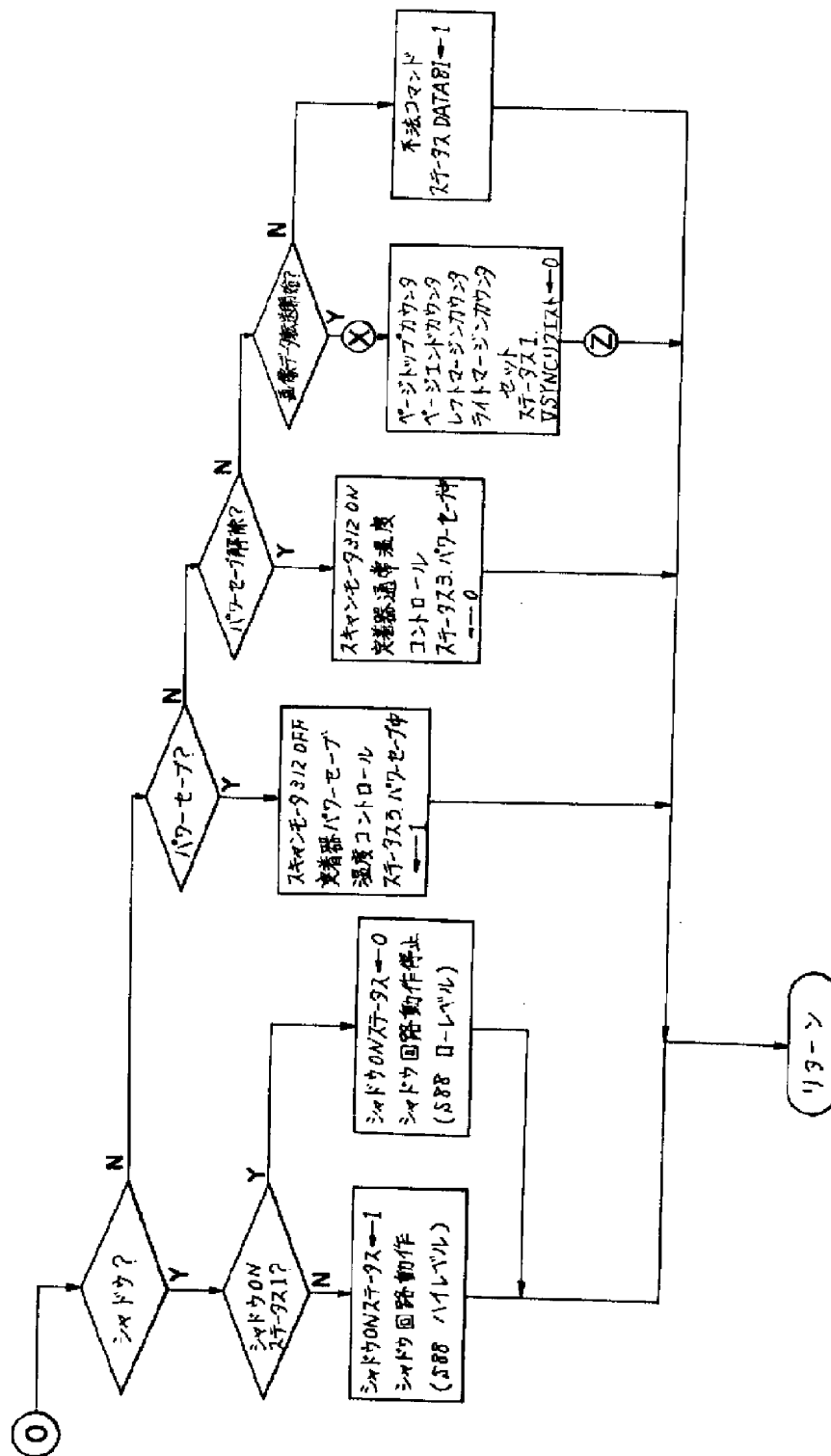
表示	交更モードNO.内容
0	空
1	ドラム特性(A)
2	ドラム特性(B)
3	ドラム特性(C)
4	ドラム特性(D)
5	ドラム特性(E)
6	ヒートローラ交換
7	現像剤交換



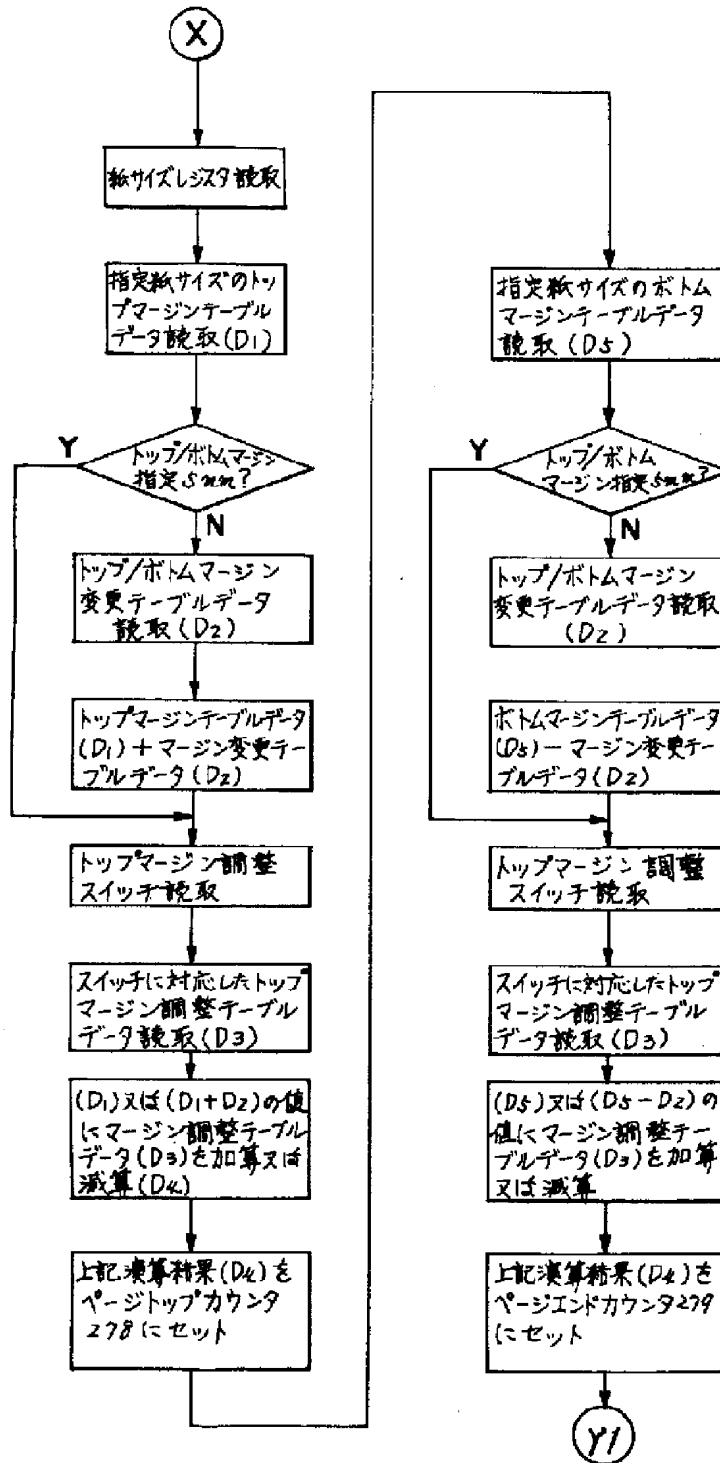
【図 5 4】



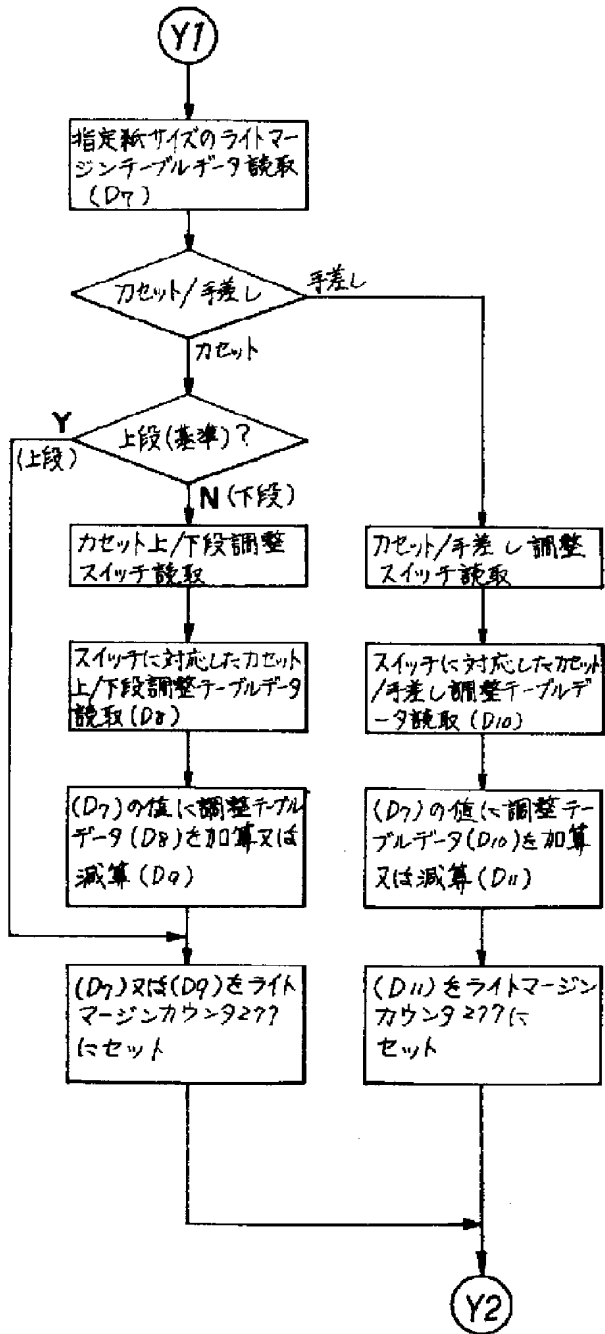
【図55】



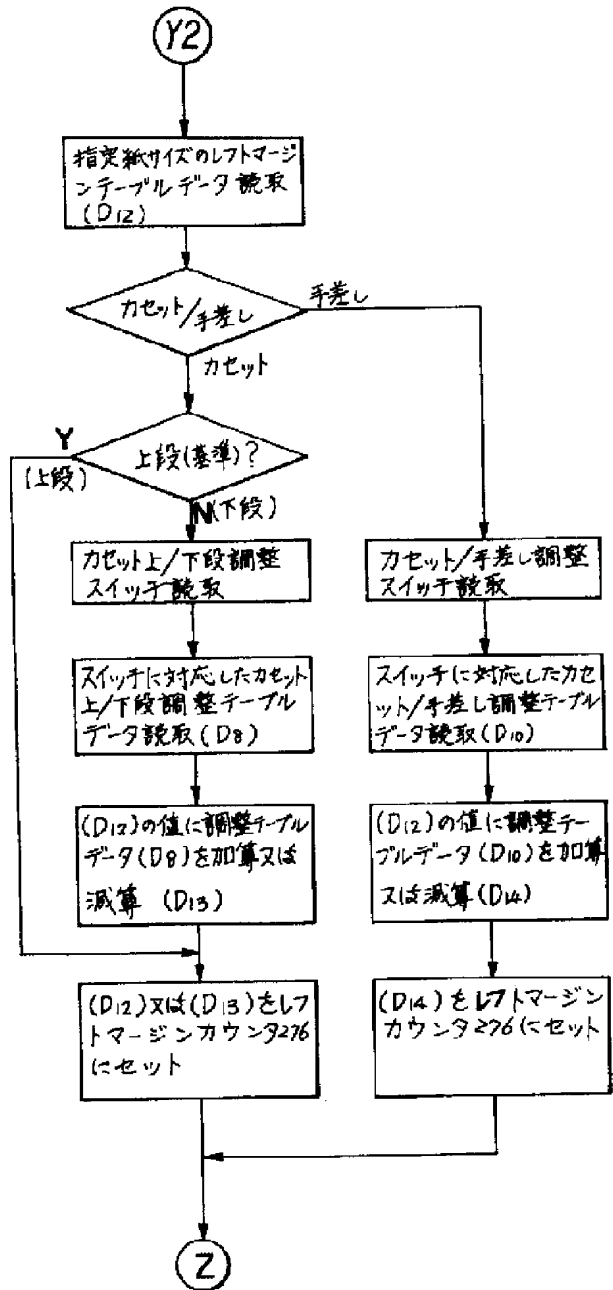
【図56】



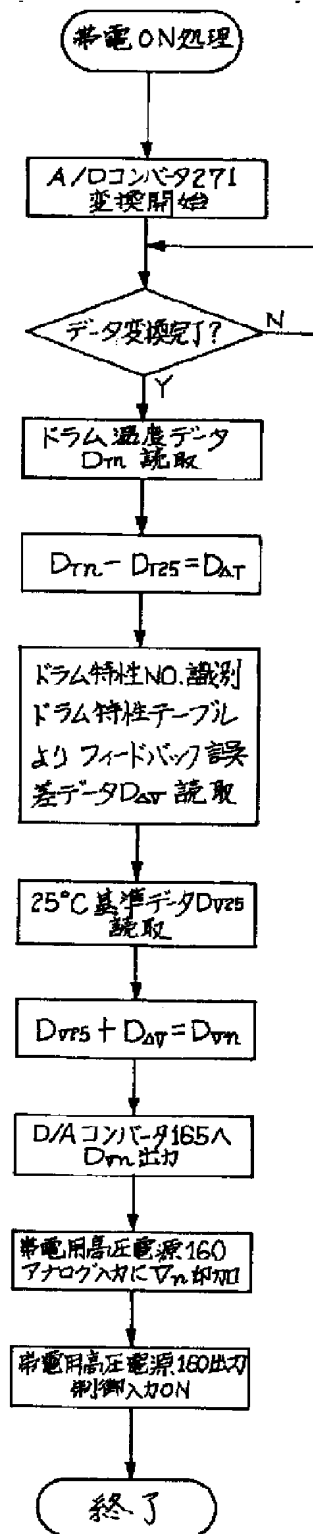
【図57】



【図58】

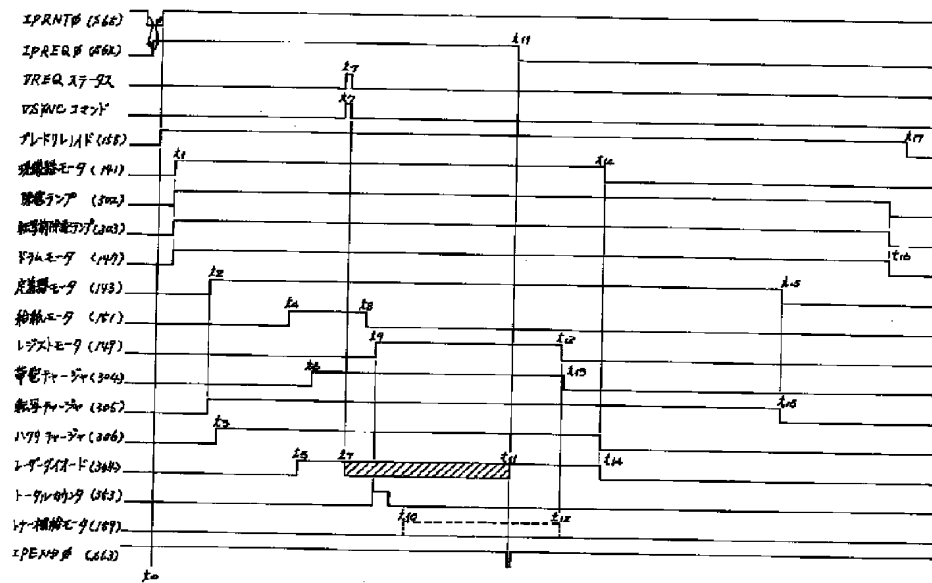


【図59】





【図60】



【図63】

